THE
MADRAS JOURNAL
OF
LITERATURE AND SCIENCE,

PUBLISHED UNDER THE AUSPICES

OF THE

MADRAS LITERARY SOCIETY

AND

AUXILIARY OF THE ROYAL ASIATIC SOCIETY.

VOL. IX.

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EDITED BY

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MADRAS MEDICAL ESTABLISHMENT,

AND

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MADRAS CIVIL SERVICE,

SECRETARIES TO THE ASIATIC DEPARTMENT OF THE SOCIETY.

VOL. IX.

January—June 1839.

MADRAS:

PRINTED AT THE ATHENÆUM PRESS,

BY J. B. PHAROAH, AND PUBLISHED BY J. P. BANTLEMAN,

AT THE COLLEGE.

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NATURAL HISTORY

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OF

LITERATURE AND SCIENCE.

No. 22—January 1839.

I.—*Fourth Report of Progress made in the Examination of the* Mackenzie MSS., *with an Abstract Account of the Works examined.—By the Rev.* William Taylor, *Member of the Madras Literary Society, &c. (Continued from the last No.)*

B :—TELUGU.

a. Palm-leaf Manuscripts.

The following manuscripts are portions of a version of the *Mahabhárata.*

Adi-parvamu, or the first book of the *Bháratam,* No. 1.—Countermark 161.

This copy contains from the beginning down to the 241st palm-leaf, without intermediate defect; but all the remainder is wanting. The manuscript is very old: the hand writing somewhat antique; and the leaves are damaged, in several places, by the eating away of the edges; so that portions of the nearest line have words eaten out.

2. *Adi-parvam,* No. 2.—Countermark 162.

This copy is complete at the beginning, and down to the 208th palm leaf; the remainder is wanting. It is a comparatively recent copy; but the leaves are perforated by insects in several places; so as occasionally to destroy some letters, but not so as to destroy legibility.

3. *Adi-parvam,* No. 3.—Countermark 163.

This copy wants the 1st leaf, it is then right down to the 22d leaf; deficient afterwards to the 190th and thence to 114th; right afterwards to the 144th: so far very old. A more recent hand writing follows, beginning with the 185th leaf; right thence to 188. No. 189 is wanting. From 190 to 214 is right; defective to 217; right thence to 227. No. 228 is wanting; thence right to 226, defective to 242, right thence to 245, and defective to 254. The remainder complete down to 288, the end.

This manuscript is very old. The former portion more so than the other, which is in a different hand writing. It is also damaged; not so much by insects, as by the wear and breaking of the leaves by decay.

4. *Adi-parvam,* No. 4.—Countermark 164.

Of the eight *asvásams* (or sections) into which this *parvam* (or book) is divided, there are in this copy the 5th, 6th, 7th and 8th: there are nine leaves wanting from the beginning of the 5th: the other sections specified are complete. The leaves were not numbered; causing so much the more trouble in the examination: the Nos. of the pages have been inserted; and the contents compared with another copy, not belonging to this collection.

This MS. (No. 4) is but lately written; both palm-leaves and hand writing being quite recent in appearance.

5. *Sab'ha parvam,* or the second book of the *Bhàratam,* No. 5.—Countermark 265.

In this MS. the 9th palm-leaf is wanting; thence it is complete to the 59th leaf, which is the end.

This copy is very old; injured at the edges, but not inside.

(The third book, or *Vana parvam*, is not in the collection).

6. *Viráta parvam*, or the fourth book of the *Bhâratam*, No. 6.—Countermark 266.

The beginning is found in this copy to the 20th leaf, with a chasm thence to the 50th leaf. Thence right to the 146th leaf. The MS. is old; though apparently not quite so old as the last. It is a little worn at the edges; and very slightly touched by insects inside; neither amounting to injury.

7. *Udyoga-parvam*, or fifth book, No. 7.—Countermark 267.

This copy is complete from the beginning up to the 139th leaf, which is the end; or, in other words, it is a complete copy, save only, that the wearing or breaking away at the edges, and the breaking off of a few leaves inside, occasionally destroys the coherence of the versification, and meaning. The copy is rather old.

8. Another copy of the same, No. 8.—Countermark 268.

This is a recent copy, as to palm-leaves, and writing; but not finished; from the beginning to the 36th leaf is found herein; the rest is wanting.

9. *Bhishma parvam*, or ninth book, No. 9.—Countermark 269.

This copy is right from the beginning to the 89th leaf. There is then a mistake in the numbering of the leaf, 100 being written for 90; but the connection of the composition is uniform. It is then right to 136, the end; by consequence a complete copy, save only that the 21st leaf is broken off, and part of it wanting. The book is slightly worn at the edges, and touched by insects: but these do not affect or injure the meaning. The copy is a little old.

10. Another copy of the same, No. 10.—Countermark 270.

The first ten or fifteen leaves are seriously damaged, by insects. The copy is otherwise complete; containing 146 palm-leaves in all. There is attached a copy, not perfect, of the *Dasarathi sataca*, by *Rama-dasa*, containing a eulogy of *Rama-Chandra* as *Vishnu*, appearing under ten metamorphoses, or incarnations.

Both MSS. are rather old ; and both injured by insects.

11. *Dróna parvam*, or seventh book, No. 11.—Countermark 271.

This copy is complete in 227 palm-leaves; but these are old, especially the first 45 leaves; which are also injured by insects. The remaining, and seemingly more recent, portion, is not touched.

12. *Kerna-parvam*, or the eighth book, No. 12.—Countermark (wanting).

A complete copy in 90 palm-leaves; old, but notwithstanding in good preservation.

A few palm-leaves are appended, containing panegyrical stanzas addressed to the consort of *Siva*.

13. *Kerna-parvam* (another copy), No. 13.—Countermark 273.

This MS. is complete, as regards the *parvam* itself; though the paging is from 2 8 down to 362, as part of a fuller copy of the *Bháratam*. This copy is a little old; but in very good preservation.

14. Another (imperfect) copy of the same, No. 14.—Countermark 274.

The two first palm-leaves are wanting; but from p. 3 to p. 16, the leaves are regular; the remainder is wanting. A few loose leaves follow, apparently belonging to the *Adi-parvam*, of some copy different from those in this collection. What remains of this fragment is in tolerable good order.

15. *Salya parvam,* or the ninth book of the *Bhàratam,* No. 15.—Countermark 275.

This copy contains from page 138 to 332; the intermediate leaves being regular; and the numbering indicates that the MS. is part of a larger one, since the *Salya-parvam* is herein complete. The manuscript is rather old; slightly worn at the edges; and but slightly touched by insects inside. It may be considered to be in moderately good preservation.

16. Another copy of the same, No. 16.—Countermark 276.

This copy is also complete; though the numbering is from page 363, down to page 507, the end. It is much older than the preceding copy. It is also more worn, and injured inside; particularly in a few leaves at the end; and appears to have formed a part of one entire copy of the *Bháratam.*

17. *Sauptica-parvam,* the 10th book, No. 17.—Countermark 277.

The copy is complete as regards this *parvam* itself: though the numbering of the pages is from 252 down to 296, indicating it, as before, to be a part of a fuller copy of the *Bháratam.* This MS. is a little old, and somewhat worn at the edges; but in good preservation inside.

(The eleventh book is not found in the collection).

18. *Santi-parvam,* the twelfth book, No. 18—Countermark 278.

This copy is complete in itself; but the paging is from 152 down to 348. This MS. is old; worn at the edges; discoloured inside; damaged at the beginning; and more seriously at the end, by insects.

As regards the entire work of the *Mahabhárata,* an abstract of its voluminous, and multifarious, contents will not be expected, or required from me in this place. In the original Sanscrit, especially, it is a work of first rate consequence; and has received, as such, attention from all enquirers into Oriental literature. It is one of the *Itihasas*; and secondary in esteem only to the *Vedas*; in some instances to the *Puranas.* There is much of early history contained in it; though not satisfactory

in character, because fact and fiction cannot be easily disentangled. The Telugu work is a translation from the Sanscrit by *Nannaiya Bhatt*, and his disciple *Balasarasvati*, according to one account; according to another account by *Tikana-Somayáji*, completed by *Potaiya*, or *Bommana-pota-raja*. A third account, that of Professor Wilson, states the translation to have been by *Nannaiya Bhatt*, down to part of the third book; completed by *Tikana Somayáji*. Possibly there are two or three different versions.

It will be seen by attention to the foregoing details, that a complete copy could not be made of the MSS. in this collection, without extraneous aid. The idea of forming such a copy has occupied my mind; but time and expense seem to forbid the doing so; and need does not urge it, just at present; for the copies will not suffer much further injury, for a year or two, and whenever the formation of one complete copy may be attempted, other copies, to collate with these, must be procured. One copy, uniform with the other restored MSS., would probably fill two folio volumes, at least. I have already incurred expenses for restoration of MSS. considerably beyond my allowance for copyists; and the time required to form such a collated copy would seriously interfere, with the successful, and timely, discharge of my obligation in the other, and more important, parts of my engagement. Hence so laborious a work, with regard to one poem (however valuable), is not my present duty. Should any ulterior process arise out of the present examination, I would then recommend the making such a restoration as a good record copy.

The following four manuscripts are portions of a version of the *Bhágavata puránam.*

19. *Panchama-Scandham*, or the fifth book of the *Bhágavatam*, No. 22—Countermark 284.

This is a complete copy of the fifth book of the *Bhágavatam*; but the numbering of the pages, from 221 to 253, shews it to have belonged to a complete copy of the whole work. This MS. is neatly written; is rather old; but in good preservation. The version is poetical by *Bommana-pota-raja*.

20. *Saptama Scandham*, or the seventh book of the same, No. 21—Countermark 282.

This portion is complete, as a distinct book. It is quite recent; slightly touched by insects at the beginning, but of no consequence, as to extent of injury.

21. *Ashta-Scandham*, or the eighth book of the same, No. 23—Countermark 283.

This copy is imperfect, both at the beginning, and at the end. It wants 20 leaves at the beginning, and how many at the end cannot be determined. A recent marking of the leaves in *ink*, would imply a complete work from the 1st page, which is deceptive. The fragment is not very old, as to leaves and copying. It is also but slightly injured.

22. *Dasama Scandham*, or the tenth book of the same, No 21—Countermark 285.

This is a complete copy of the tenth, and also of the eleventh book. The manuscript is neatly written, is not very old, and in perfectly good order.

An abstract of the *Bhagavatam* being in progress, nothing further is here necessary to be added. It may only be expedient to mention, that in Sanscrit, *Candam*, and *Scand'ha* alike denote a book, section, or chapter. The Tamil translator adopted the former word, as better suited to the Tamil orthoepy; the Telugu translator has employed the more usual term, as the Telugu alphabet contains representatives of all the Sanscrit letters and sounds.

22. *Ranganát'ha Ramáyana* a version of the *Ramáyanam* by a *Brahman* named *Ranganát'ha*, No. 99.—Countermark 399.

This manuscript is very old, and exceedingly injured; not so much from the ordinary cause, that is insects, as from wear and tear by use. The leaves are broken off in the middle, a half only remaining; or broken partly, a larger part remaining: many entire leaves are wanting; and the whole so very deficient, that a particular enumeration of defective parts would be equally tedious and useless.

23. Another copy, No. 100.—Countermark 400.

This is a very small, and still more imperfect, manuscript. It wants the beginning, and the ending; is not regular in the middle; and though not so much broken by use, as the last copy, yet is injured in this way, chiefly at the two ends. It is not touched by insects. It does not seem any way possible to form one complete copy from both of these fragments. Being a popular book, it can always be procured, as it is very common northward of Madras. It is the production of the aforesaid *Brahman* composed in the *dvi-pada* measure; and written under the patronage of *Buddhana Siddha-redi*, a chief in the Cuddapah district, who bestowed money very liberally on him. As it is a version from the well known Sanscrit poem, an abstract of the contents is not required.

Note.—Both MSS. are entered in Des. Catal. vol. 1. p. 335. art. 51. One copy is termed incomplete, implying the completeness of the other one; an inference that would be ill founded.

24. *Sarangadhara Charitra*, tale of *Sarangadhara*, No. 61.—Countermark 407.

This is a fragment of a poem by *Chamakuri-Vencatapati*; a work of romance or fiction; the hero being *Sarangadhara* son of *Bhoga-devendradu*. The incidents are not of a kind to be abstracted here; and I therefore refer to the very sufficient notice of them in art. liv. page 337, vol. 1. of the Des. Catalogue. This fragment has the appearance of being very old, and is a very small part, of what I understand to be properly a large work.

The subject is that of the two Tamil manuscripts, noticed in the foregoing portion of this report. A. *a*. 24 and 25. Nos. 117 and 118.

According to the Des. Catalogue there should be another copy in prose, on this same subject, in Telugu, which manuscript apparently is not now in the collection.

25. *Bhoja-raja-Cheritra*, the tales of *Bhoja raja*, No. 68—Countermark 351.

The book is a fictitious work on the plan of the *Pancha-tantra*, and similar productions. It is not concerning *Bhoja-raja* himself; but the

different tales are represented as having been narrated to him by *Sarpata Siddha.* One of the tales at the commencement relates to a great hunting match, made by a king of the *Anga* country to destroy the wild beasts by the advice of his ministers ; and other tales are of a like artificial structure : the object in view is to teach stratagems, artful devices, and cunning, adapted to outwit others. It is in good Telugu ; but with orthographical faults. The book is complete, and in very good order.

Note.—It is entered in the Des. Catal. vol. 2, p. 321, art. xi. at least I suppose it to be the same work; though in the Catalogue it is stated to be imperfect.

26. *Nala Charitra,* the story of king *Nala,* No. 35.—Countermark 385.

This is an old manuscript. Palm-leaves are wanting from 13 to 28, the remainder continues in regular order forwards; but it is not complete at the end; where besides it is especially damaged. It contains a poetical account of the fortunes of *Nala-rája,* founded on an episode in the *Mahabhárata.* Versions of the tale are found in all the languages of the Peninsula. There is no need of abstracting it here ; and the complete restoration of the manuscript is impracticable, without possessing another copy of the same poem, I therefore pass it by; seeing that the mere local poetry, or *belles-lettres* of any section of the *Hindus,* is not the object of my enquiries.

Note.—It is briefly entered in the Des. Catal. vol. 2, p. 332, art. xxxix. "The story of *Nala* and *Damayanti,* as taken from the *Mahabhárata.*"

27. *Sesha-dherma,* or *Hindu* morality, No. 20.—Countermark 280.

This is a poem divided into seven sections, each one entitled a *satakam ;* the usual name of a distinct work of one hundred stanzas. These sections are as follows :—

1. *Mukti Canda-satakam.*
2. *Parámanda-satakam.*
3. *Rama-shadácshari-mantram.*
4. *Daltátraya-satakam.*

5. *Sampanga-mana-satakam.*
6. *Sesha-dherma.*
7. *Sesha-dherma shashta-másvásam.*

The first contains various formularies used by *Brahmans*, and relates to the qualities of the soul, and especially to the homage paid to *Siva.*

The second is an epitome of the meaning of the *Sastras*, and meaning of the doctrines of spiritual preceptors, still according to the *Saiva* system.

The third contains the various *mantras* on the *Vaishnava* system. The repetition of these formula is marked and numbered by certain gestures on the hands, members of the face, and head; and the repetition, when bathing, and at other times, is a part of the manual, and mental; devotion of *Vaishnava* votaries.

The fourth proceeds on the example of an elephant, when seized on by an alligator, praying to *Vishnu*, who hurled his *Chacra* and killed the alligator: whereon is founded the instruction that votaries who in time of trouble call on *Vishnu* will be delivered, by his sending down his *Chacra*, or effecting some marked interposition, on their behalf.

The fifth contains explanations on the nature of *Vishnu*, as to his spiritual form; the said form pervading the universe. It inculcates truth and spiritual homage, and appears to contain the *esoteric* doctrines of the *Vaishnavas.*

The sixth relates to gift of food, of place, of land, of a cow, &c. with a comparative estimate of the relative value of different donations.

The seventh contains narratives of different individuals; notices of sacred places; special days of peculiar virtue, and merit of bathing thereon; merit of charitable gifts on Sundays and Mondays, as narrated by *Bhishma* to *Dherma raja.*

The first *sataca* contains 196 stanzas, the second 111 stanzas, the third is a continuous series of formularies. The fourth contains 103 stanzas, the fifth 123 stanzas, the sixth and seventh are irregular, and without any specification of number.

At the beginning four palm-leaves are wanting, and I have not the means of restoring them at present. The book is damaged by reason of insects having eat away the edges; forming, so to speak, the small margin, but leaving the writing uninjured. The work is partly compiled from the *Mahabharata*, by *Kondia Srinivasa* who lived in a village of the *Rajahmahendri* district. The leading title of the work is taken from the two last sections. *Sesha* is shortened from *Adi-sesha*, the

thousand headed serpent, on which *Vishnu* is fabled to repose, as some say an emblem of eternity ; and *dherma* is a word which signifies, justice, equity, benevolence, morality, alms, or ritual observance. The reader may thence frame his own translation of *Sésha-d'herma.*

The book is a valuable one. A literal translation would be of great use towards a full acquaintance with the *internal* system of the *Vaishnavas* ; which is not the one commonly inculcated on the people.

Note.—It is entered in the Des. Catal. vol. 1, p. 270, article xii ; with an error as to the contents being derived from the *Bhagavat,* most probably an oversight or misprint, or possibly a mistake of the ear ; the borrowed part of the contents is from the *Bhâratam.*

b. MANUSCRIPT BOOKS.

Manuscript book, No. 36—Countermark 286.

The *Vishnu-Upa-puranam.*

This is a version in Telugu of the above *Upa-purana.* There are eight books or sections ; of which the sixth is incomplete. The most remarkable portion is the 5th and 6th books, containing the *Surya,* and *Chandra vamsas.* The opening part is stated as if received from *Pulast'hya,* one of the seven great *rishis.* It relates to primal matters ; being little more than a repetition, or summary, of subjects contained in other *Puránas.* The different *Manuvantaras* ; the seven *dwipas* ; the measures of time ; the incarnations of *Vishnu* ; and connected topics ; are adverted to. The seventh, and eighth books, or sections, relate to the birth, adventures, and public acts, of *Crishna.* In this part, and indeed throughout the whole, there is a great apparent resemblance to the contents of the *Bhágavata puranam.* In the early portion especially, there is, I am persuaded, much enigmatical, or symbolical, writing and when such a veil is studiously employed, as seems to be the case in all early *Hindu* writings, it may be inferred, that the earliest colonists of India wished to conceal their true descent, or to falsify something concerning themselves ; as all the researches which have been made, or are now being carried forward, seem to render abundantly probable.

Note.—The writing of this book is very legible ; and the paper but very little damaged. Its restoration by consequence does not seem to be urgent. As to translation such might be best made from a copy of the

original Sanscrit work. Should however no such translation be likely to appear, then it might be desirable to give the contents of this manuscript, an English rendering, after matters more strictly relating to the peninsula-history have been attended to, and dismissed.

Manuscript book, Nos. 37 and 38.

It is necessary to class these two books together, as their subject is the same; that is local accounts of villages in the Northern Circars; with a special reference to the settlement of the *Niyogi*, or secular, *Brahmans*, as village accountants. They relate to the cleaning of waste, or forest lands, location of colonists, and the consequent building of villages, with fanes, and *mantapas*, the excavation of water reservoirs, and other details.

Both books are so greatly damaged from the effects of damp, or of salt water, and of the attacks of termites, as to be *irrecoverable*. It seems probable, that the restoration, were it practicable, would not be a matter of much consequence; but whether so, or not, the sense is so prevailingly lost, that nothing now can be done with the books, in the way of remedy.

From looking over the whole of the sections, wherever any sense can be made out, the following seem to be the general indications; as far as historical matters are concerned.

There are references to *Visvambara-deva* a *Gajapati* prince. The *Ganapati* prince is described as his offspring, and the date of Sal. Sac. 1056 (A. D. 1134), is given, as that of his installation. He made gifts of waste lands to *Gopa-raju* and *Ramana*, descendants from the *Aruvela-niyogi*-race, or secular *Brahmans*. These again subdivided the country into smaller districts among other *Niyogi-Brahmans*; and the country in this way, became peopled, and civilized. The preceding state of government gave way to that of the *Reddiváru*, which was superseded by the *Carnataca* rule. This was followed by the ascendancy of *Crishna rayalu*. His power yielded to that of the Mahomedans; and these were superseded by the Honorable Company.

Note.—These two books are entered in the Des. Catal. vol. 2, p. 18 and 19, art. xxxvii. and xxxviii., with a copy of the table of contents, prefixed in English to each of the books, which from what remains of those indices can be ascertained to be the same. As the books are irrecoverably damaged, a reference to the Catalogue may now suffice; without copying those indices in this place.

Manuscript book, No. 18.—Countermark 911.

Report of the progress of *Ni'ala Narrayan* through the *Malayalam* and *Conga* countries from 1807 to 1813.

The book is endorsed as among *Malayalam* papers; but these reports, in a series of papers, are in the Telugu language and character. The book is in a state of indifferent preservation; but does not require further notice.

Manuscript book, No. 19.—Countermark 912.

A continuance of reports from the same person in the Telugu language and character from 1816 to 1821. It is damaged by insects.

Manuscript book, No. 50.—Countermark 740.

Report of progress of *Narrayan rao* through the *Vencata giri* district, for 1814.

This book is endorsed as among Telugu papers. The first half of the contents are in Telugu; the latter half in Mahratta. The subject a journal of operations like the foregoing. It is slightly injured by insects.

Manuscript book, No. 51.—Countermark 741.

Report of progress of *Narrayan rao* in the *Vencata giri* district from April 1814 to May 1815.

A continuance of the journal from the last mentioned document, wholly written in the Telugu language; and in tolerably good preservation.

Note.—Journals of this kind do not seem to me to be of permanent interest, or importance. Hence I dismiss them with the simple mention.

Manuscript book, No. 4.—Countermark 694.

This book according to the English heading of contents (partly destroyed) once contained copy of an ancient record of *Kondavir*, and

its rulers, with a notice of the village accountants, and limits of certain districts in the Telugu country.

The book however is now so seriously injured, that it may be said if not to be destroyed by insects, yet to be so damaged as to leave no legible meaning. As such the book is of necessity passed by as *irrecoverable.* There is I think an account of *Kondavir,* in another paper belonging to the collection.

The book is entered in Des. Catal. vol. ii. p. 3, art. iv. simply copying the English table of contents.

Manuscript book, No. 9.—Countermark 699.

This book, like the last one is *irrecoverable;* being, if possible, in a worse condition. The first section referring to the *Comti,* or *Banian,* class of people at *Pennaconda,* might have been prevailingly recovered, had there not been two leaves at the beginning wanting, rendering the remainder destitute of value. The second section is most to be regretted as, according to the Des. Catalogue, it contained accounts* of the *Konda vandlu, Koya vandlu,* and another wild tribe, residing on the mountains, and in the woods, of the *Rajahmahendri* district. The remaining four sections would have been of less consequence. From the book itself, quite irrecoverable, nothing can be made out. All that can be done is to refer to the Des. Catalogue, vol. 2, p. 5, art. ix.

Manuscript book, No. 25.—Countermark 281.

This book contains the remnant of two sections.

1. "*Sesha-dherma-ratna-carum,* or rules supplementary to the *Mahabharata.*"

This title, in the English table of contents prefixed, is erroneous.

2. *Rangha rao charitra,* or account of a sanguinary battle between *Rangha rao,* a zemindar of the *Velmavar* family of *Bobili* in the *Calinga Circar,* with the chief of *Pusa-pati* named *Vijaya-rama raz,* and Monsr. Bussy, a French general under *Nizam ali Khan* of Hyderabad.

* Perhaps the loss is remedied by similar notices in a following book.

The former section is entered as a paper MS. in Des. Catal. vol. 1, p. 270, art. xii under the same title with the *Sesha D'herma* (before noticed) but is described as an introductory fragment, giving only the genealogy of *Timma raja*, zemindar of *Peddapur*. From an examination of the remains it appears to be a eulogy of *Vencata Crishna Raja* composed by *Timma raz*. A genealogy is connected with the panegyric. *Vencata* is merely an epithet, and it seems to me that the poem relates to the famous *Crishna Rayer*. Indeed I can have no doubt of it, inasmuch, as *Timma raz* was one of the eight celebrated poets of *Crishna Rayer's* court.

The other section is entered in the Des. Catal. vol. 1, p. 315, art. xxi, with some brief indication of its contents, and a reference to Orme's History, vol. 2, part 1, p. 254.

The contents of the book are now *irrecoverable*: they were written on thin country paper, in which large lacunes, in various parts of each page, are completely eaten through by termites, or other insects, and the leaves are in some places so glued together, in the manner common with these insects, that they cannot be separated without tearing: the loss is apparently not of grave consequence. From an examination of the 2d section it appears that the notice in the Des. Catalogue is sufficiently accurate. There is I understand a very long poem on the subject.

Manuscript book, No. 67.—Countermark 864.

This book contains three reports, or journals, of *Ráma dasa*, in his journeys through the Ceded Districts, in search of the antique and curious, from June to December 1809, from January to September 1810, and from October 1810, to May 1812. The paper is only a little injured; the ink good; and, as it is, the book will last many years, with only common care.

I do not make such journals the subject of abstract, or special observation.

Manuscript book, No. 10.—Countermark 700.

Section 1. Account of *Vira Crishna deva* the *Gajapati* prince of *Bárábatti*, or *Cattacapúri*, in the *Udiya* country.

In early times *Vira Narasimha Gajapati* ruled in the above mentioned town; conquered the king of *Calinga-desam;* and subdued other countries. He built, and had set apart, a fane to *Varaha Narasimha svami. Vira Capilésvara Gajapati* built an *agrahâram* and a fane, on the banks of the Godavery river. *Purushóttama Gajapati* built a village, and an *agrahâram* on the sea shore, bearing his own name: he also built and had set apart, the fane of *Jaganát'ha.* His son was *Pratapa-rudra Gajapati.* His rule to the westward, especially over certain fortresses and villages, was rather more extensive than that of his predecessors. While so ruling *Vira Crishna Raya maha rayalu,* coming from the west, drove away the said *Pratapa-rudra;* and, after remaining some time, returned. The fugitive prince took refuge in the town, or village, called *Andhramanémam.* After some lapse of time, *Vira Crishnadeva* of the *Gajapati* race ruled. He gave his eldest daughter in marriage to *Bâhu Balendra Vira Mukunda-raju;* and his youngest daughter to *Basava raju* son of *Mádhaverma,* of the *Pusapatti* race, of the town of *Bezavádà.* These two sons-in-law he kept in his own palace. The latter being the most handsome of the two, the marriage on the part of the king's youngest daughter, was one, on her part at least, of affection ; and, by her means, the young man became a favourite with her father. The king at all times wore a sword, on the possession of which his kingdom, and authority, were considered to depend. The young man *Basava,* abusing the confidence reposed on him, contrived by stealth, and in a way which the manuscript styles mean and unworthy, to get possession of the sword, expecting the kingdom to follow. A great disturbance arose ; but the king at length regained the valuable heir-loom of his race. He then sent away the said son-in-law to his own town ; together with wife and dower. He caused an illegitimate son to be installed as his heir to the kingdom ; to the prejudice of three legitimate sons. Disgusted at this preference, the eldest of the two legitimate sons went away to *Jaya-puram,* and established a rule over nine *pálliyams,* or districts. The second son established a rule over nine districts in the *Kimedi*-country. *Bhimadeva,* the third legitimate son, laid the foundation of *Vijayanagarum* (that is what is commonly written *Vizianagarum* in the Northern Circars, not Bijnagur on the Toomboodra river). He there established a rule over twelve *pâlliyams,* or districts. After the death of the aforesaid *Vira Crishna deva Gajapati,* the husband of his youngest daughter; that is to say *Basava raja,* killed *Balendra,* the husband of the eldest daughter ; and took possession of the district which had been given to the said *Balendra* as a marriage portion. At this time the *Mléchch'has* (barbarian foreigners) took possession of the aforesaid town of *Cattacapuri* (Cuttack).

The before mentioned *Bhimadeva-Gajapati* leaving no offspring, six of his *Palliyams* were united with the *Kimedi*-country, pertaining to his elder brother. The remaining six districts were united with the *Jaya-pur* sovereignty of the eldest brother. *Sita-Rama-Chandralu*, of the posterity of the before mentioned *Basava*, conquered the two countries of *Jaya-pur* and *Kimedi* ; and also levied tribute from them, in acknowledgment of his sovereignty. This *Sita-Rama-Chandralu* had no offspring : he adopted one of his own *Pusapatti*-race, who was named *Vencatapati-raju*, who succeeded him on his death. His manager, or minister, named *Bandi-Jaga-rao*, took possession of the kingdom, and put the said young man, *Vencatapati* in prison. While himself ruling in his usurped authority the younger brother of the one imprisoned, who was named *Ananta-raju*, and was in the service of the Golconda Nabob, with troops of the latter overthrew, and killed, *Nilacont'ha-raju*, the general of *Jaga rao*, and also *Jaga rao* himself. He then re-instated *Vencatapati* as king, and became his second in authority. They relinquished *Portnur ;* and built another *Vijayanagaram*, forming a fort, and residing therein. This *Vencatapati* had a son named *Sita-Rama-raju* ; and *Ananta raju* had a son named *Vijaya-Rama-raju*. These two children disagreed ; and ruled separately, until *Sita-rama-raju* died. His son *Ananta-raju* was brought up by *Vijaya-rama-raju* who conquered *Timma-raju* of *Peddapuram*, putting his son in the father's place, he also killed *Nagaji Hussein Khan*. He also took tribute from Cuttack and other places. The Mahomedan ruler of Golconda thenceforward acquired an ascendancy ; and established different rulers, by his firman, or edict. The name and influence of Monsr. Bussy the French general is subsequently introduced. Hyder Jung was his agent in the management of French affairs, in the Northern Circars. The ruler of *Bebulli Cotta*, whose ancestors from the time of *Ananta-raju* had been adversaries, and had introduced the Mahomedan ascendancy, was now oppressed in return. Soon after the country was conquered, from the Bengal side, and became subject to the Honorable Company. The rule of chieftains, under them, continued down to *Narrayana Gajapati*, who ruled at the time when the manuscript was written.

Section 2. Account of the *Cóndu vandlu*, a wild tribe residing in the *Jayapur* district of the Northern Circars.

A distinction is to be noted between the *Cóndu Cóthu* (or *Kondoo*), *vándlu* and the *Conda* (*Konda*)-*vándlu ;* the former class of people form the subject of this section; the *Conda-vándlu* of the next one.

The *Cóndu-vándlu,* dwell in hills and passes of hills; in rude huts, like cow-sheds. They are very careful of water-springs. They beat, and plunder, solitary travellers: some use brass vessels: some dry gourds; some earthen vessels. In every house two or three dogs are reared. Their chief has the title of *Nayak;* inferior chiefs are termed *doralu.* The villages pay from six to thirty rupees, as tax. The *Nayak,* on receiving the tax, points out, and assigns lands to different individuals. They cultivate *Cholam* (Holc. Sac.) and other dry-land grains; as also rice in the wet lands: the poorer sort, sell a portion of their grain, to pay their tax, and live on the rest, as also on the proceeds from tamarinds produced on their lands. Both sexes labour in the cultivation of grain. They labour in their fields, from day break till noon; when, from their position, it is very cold. At noon the power of the sun produces great heat, and thirst, which induces them to cease from work: they make large use of butter-milk, and other beverage, the effect of which, according to the manuscript, is to make them pot-bellied, with small legs and arms, and causing unhealthy aspects. In the hot season they sleep wherever they please. In the rainy season they sleep on couches within doors, having stoves, or similar things, inside to warm their dwellings. They place a watchman at night on a stage in the fields, to protect the corn from beasts. The *Paindu-vándlu,* a class of *pariars,* weave their garments; which, as worn by the men, are a cubit and three quarters in breadth, and sixteen or seventeen cubits in length. The women's cloth is not quite so long. As they are very uncleanly in their persons, so they emit an offensive smell. The men wear a crown-tuft of hair. They wear finger rings of brass, or other mixed metal; some have them of silver. Their language is distinct; and if they speak Telugu, it is with an imperfect utterance. Their marriages are fixed, as to time, by an astrologer whose influence extends over from forty to fifty villages. Some specification is given of their marriage-ceremonies; the eating of flesh, and drinking strong liquor, being a part. They have some other ceremonies, connected with the age of their female offspring. Their *pusari* is termed *Jani vándu;* the *numen* worshipped is called *Jacara,* a sylvan god. In order to promote the growth of grain in their fields, they give a portion of grain from a former crop to the *Jani,* who then performs a ceremony, by offering some leaves, and anointing the image of *Jacara.* The same thing is practised, through fear of tigers, for the sake of protection. The caste-thread is not worn by any among this people; with one exception, in the case of *Vencatapati raju* of *Pála-cónda-vira Gottàm;* who, exercising kingly power, puts on the thread, but without any attendant ceremony. The *Cóndu vandlu* are also termed *Játápa doralu;*

and it is immaterial whichsoever of the two names is used. They are one and the same people.

Section 3. Account of the *Conda-vandlu* people, in the *Jayapur* district.

They wear a tuft of hair on the top of the head, in the form of a ball; some wear mustachios, and some use the *Saiva*-burnt ashes, on their foreheads. They do not speak good Telugu. They dwell on hills; are of disagreeable appearance; cultivate grain in suitable places; pay taxes; watch the grain on platforms. Some wear a dagger in their girdles; carry muskets; tie a handkerchief on their heads; and do the work of peons, or soldiers. They receive pay in an allowance of grain, so much per diem. They dwell in sheds, like cow-sheds. They chiefly use earthen vessels; a few people only have vessels of brass. A specification of dress is given; and of some customs of the females. The chief with the title of *raja*, wears the *punnal*, or caste-thread. Other chiefs are called *Doralu.* Before marriage they go to some distance to consult a Telugu *Brahman*; and by his means fix on the *muhurtam*, or minute, proper for the ceremony. If there is no *Brahman* near at hand, as usually there is not in places in, or near, the woods, then they call an astrologer named *Succadivi*, one of their own class. Fixing, by his aid, the proper time, they bring him to the ceremony; and he, partaking with them of flesh and ardent spirits, is afterwards dismissed. However they do not eat raw-flesh. If a husband dies, the widow may marry again. A few of the people are votaries of *Vishnu*; others of *Siva.* The women do not plough, nor use the large agricultural hoe; but they gather tamarinds, and sell them. Those persons who are employed as peons permit their wives also to engage in the same trade of gathering, and selling, tamarinds.

Section 4. Description of the boundaries of the *Jayapur* district.

It is not necessary minutely to follow in this place the details of the circumference, or boundary line, further than to mention that the district is in the proximate neighbourhood of Vizagapatam, Kimedi, and Ganjam. A variety of small chiefs, with little districts, were spread around; one being termed *Sanniyasi-raju.* On one quarter *Kirata* (or wild savage) people are mentioned; and also the *Savaralu*, a distinct people; one of whom is described as a common pest, and incendiary. The

section is not without use. It seems to me that the *Hindus* had but imperfectly penetrated the mountain-fastnesses; still possessed by aboriginal mountaineers.

Section 5. Account of the *Maliyasavarulu,* in the neighbourhood of the *Jayapur* district.

These are a people with small eyes, noses, ears, and very large faces, (Hun, Tartar, or Calmuc, class). Their hair is thickly matted together. They bind either a cord, or a narrow bit of cloth around their head, and in it stick the feather of a stork, or of a peacock, and also wild flowers, found in the forests. They go about in the high winds, and hot sun-shine, without inconvenience. They sleep on beds formed of mountain-stones. Their skin is as hard as the skin of the large guana-lizard (rough, indurated, not delicate). They build houses over mountain-torrents, previously throwing trees across the chasms; and these houses are in the midst of forests of fifty, or more miles, in extent. The reason of choosing such situations is stated to be, in order that they may the more readily escape by passing underneath their houses, and through the defile, in the event of any disagreement, and hostile attack, in reference to other rulers, or neighbours. They traffic with the grain, which they raise ; and purchase tobacco leaf, and various other trifles, in return. They cultivate independently, and pay tax or tribute to no one. Each one has a very small field ; and they are obliged to make up their subsistence by other means : among which catching hares is mentioned. If the zemindar of the neighbourhood trouble them for tribute, they go in a body to his house, by night ; set it on fire, plunder, and kill : and then retreat with their entire households into the wilds and fastnesses. They do in like manner with any of the zemindar's subordinates, if troublesome to them. If they are courted, and a compact made with them, they will then abstain from any wrong or disturbance. If the zemindar, unable to bear with them, raise troops, and proceed to destroy their houses, they escape underneath, by a private way as above mentioned. The invaders usually burn the houses, and retire. If the zemindar, forego his demands, and make an agreement with them, they rebuild their houses, in the same situations, and then render assistance to him.

In their marriage ceremonies they consult the *Succu-divi,* or astrologer, and these are similar, on the whole to those detailed with reference to the two former classes, in the two last sections. They seem to be only a variation of the same species.

Note.—This section, concerning this wild and indomitable people, to me seems a curiosity.

Section 6. Account of the *Conda Savaralu*, or people of the hills of the *Jayapur* district, in the province of *Rajamahendri.*

The women of this tribe get wood from the forest, which they afterwards sell, and exclusive of this small commerce, they also labour in the cultivation of grain in the fields. After child-birth the women are under regimen for three days only; and, on the fourth, they go out to work in the fields. There is no washerman-caste among them; hence the women wash the clothes of their households. In the hair lock, on the crown of the head, and other circumstances, they have peculiarities. They pay some small tribute; assist the chiefs in times of trouble; and dwell, not in thick forests, or mountain-fastnesses; but on the edge of the former, and near to the villages of the low country people, or *Hindus.* Hence they are a degree more civilized; and have acquired the distinctive name of *Conda Savaralu.* They hold however with the *Maliya savaralu* that kind of intercourse which consists in mutually giving to each other daughters in marriage; marking affinity of tribe. When they go to war they stick the feathers of a fighting cock, or of a stork, in their hair; and then wear garments hanging downwards to their knees. They wear a dirk or knife; carry bows and arrows; and use the horn of a kind of deer, for a trumpet. They fight only in bushes; but decline any combat in the open plain. They make night attacks; and they burn down houses. It is said that they do not regard the *wound* of a musket ball, as they have a remedy for it: they are afraid only of a cannon ball: for which, of course they have no remedy. They have no internal distinctions of tribes, or castes. Both men and women labour in the fields. The writer here says that since they have the *Janivandlu,* as hierophants, and are accustomed to eat flesh, and drink ardent spirits, at their sacrifices, they appear to *him* to be of the *Sacti*-class (an opprobrious sect among the *Hindus*). The *Janis* allow no one to approach, or to hear, while repeating their *mantras,* or formularies.

Note.—This I apprehend to be the class described by Mr. Stevenson's paper, translated by me, and printed in No. 16 of the Madras Journal of Literature and Science. Discussion and difference of opinion having arisen on the subject, I am happy to meet, in the Mackenzie papers, with documents to elucidate, and I think set the question at rest. The derivation of the word *Savaralu,* seems to be the Sanscrit word *Savara,* a barbarian or savage, with the addition of the Telugu plural *lu.*

Section 7. Account of the villages of *Chellur* and *Catéru* in the *Rajamahendri* province.

The origin of *Chellúr* is dated in the time of *Agastya*, who is said to have planted a garden, and formed a tank, with a *Saiva* fane, and a *Vaishnava* fane; at first called *Chendlúr*, and in the *Cali-Yuga* shortened to *Chellùr*. After the rule of the kings of *Ayodhya* was finished, one named *Vijaya áditya* ruled 48 years, and had a son named *Vishnu-Verddhana*. From him is deduced a line of *Chalukiya* chiefs of the *Rajamahendri* circar or province; which, if it can be depended upon, is of great value, and consequence, in an historical point of view, as to this particular.

The *Chola* conquest by *Kulottunga Cholan* is recognized. Afterwards the *Vemana* family ruled. The *Reddivaru*, and other chiefs, are specified.

The subject does not admit of abstract: but merits full translation, as a document affording historical matter, to be then judged of, by comparison with others, as to value and authority.

GENERAL REMARK. As regards the condition of this book it may be observed, that it was originally written in a fine intelligible hand, with good ink, but unhappily on thin country paper, which is greatly injured by insects. Had the hand-writing been smaller, the whole would have been irrecoverable; as the case is a restoration has been effected with tolerable success; yet not without omissions of words, in some places. That the sense is preserved may appear from the abstract given.

The paper on the *Chalukiya* kings of *Rajamahendri* is valuable; but will require to be compared with section 4 of MS. No. 12, next following. The valuable labours of Walter Elliott, Esq. in fixing, from inscriptions, the dates of some of the *Chalukiyas*, will, aided by these two papers, and other details to come, render historical deductions concerning the *Rajamahendri* principality comparatively easy, and to some degree certain.

Manuscript book, No. 12.—Countermark 702.

Section 1. Account of *Sitandam*, in the district of *Rajamahendri*.

Reference to *Rama Chandra*, who lived in privacy in the country near the Godavery-river, and had his wife *Sita* abducted thence by

Ràvana. In consequence of a particular symbol having been formed of mud in this place, it acquired the name of *Sitandam,* from *Sita.* A fane of *Rama-svami* was, at a later period, constructed. In the time of the *Chalukiyas,* they had the festivals therein regularly managed. In the time of the *Chola kings,* and in Sal. Sac. 1024, these having conquered the *Andhra* and *Calinga* kingdoms, had servants, female slaves, &c. added to the fane. Under *Pratapa-Rudra* of *Orankal* (or Warankal) all matters were carried on, in the said fane, as before. The periods of reign of three *Reddis* are specified, as follows : The *reddis* of *Condavir Polaiya-vema reddi* 12 years, *Annapota vema reddi* 30 years, *Dherma vema-reddi* 12 years. The statement follows of a *Brahman* from Golconda, on whom a daughter of a forester of the *Billa-jana* (Bheels?) fixed her affections ; and, by consent of her parents, was married to him. After two or three years residence the *Brahman* asked her to shew him any thing special in the forests. She took him to a particular place and shewed him what is termed *rasam,* or the agent in alchymical operations. He, knowing its quality, afterwards went secretly, and concealed a quantity of it in the hollow of a bamboo-cane, which he deposited in the house of a *Chetti,* or petty trader. The latter, discovering its value, stole it, and absconded: setting fire to his house in order to cover his proceeding, with a plausible pretext. The *Brahman* came to ask for his property, all knowledge of which was denied, and the *Brahman* going into the house to seek for it, perished in the flames. The trader soon after died. Of his race an old woman remained. *Dherma vema Reddi* obtained from the said matron the contents of the bamboo; and by means of it procured great wealth; but in return was troubled by the spirits of the aforesaid *Brahman,* and trader, as evil demons. Unable to bear the annoyance he, at the instance of those demons, built a fane; together with all the usual adjuncts. He also affixed their names to his own son. *Comti-Raja-vema reddi* ruled 27 years. *Raja-vema reddi* 4 years. *Cumaragiri reddi* 14 years. After a few changes, the Mahomedans from Golconda, under Ibrahim Padshah, came and conquered the country, in Sal. Sac. 1495. A few other particulars are given; relating solely to repairs, or additions to the village fane.

Section 2. Account of the village of *Boyana-pudi* in the *Rajamahendri* district.

In the opening of the *Cali Yuga, Mukundi isvara* ruled in *Darani-cota.* When bathing in the *Godaveri* he had a vision of *Bhima-isvara,* and

another local *numen;* and soon after discovered a symbolic image, in the midst of a wood, over which he had a small fane built. He maintained one *Siddha muni* a *Jaina Brahman*, who assembled several of his class and constructed a *Jaina* fane, with images inside. The king was a great patron of the said *Brahman*. A dispute took place between himself, and his wife, as to the respective merits of the *Jaina Brahman*, and the Telugu (i. e. *Saiva*) *Brahman*. In order to test their skill, the chief put a large snake in a pot, and secretly hid it under ground: he then called on the two *Brahmans* to tell him what he had done; stating that whichsoever failed to declare it, should be put to death in an oil-mill. The *Jaina Brahman* told the king he had put a snake in a new pot, and buried it. The Telugu *Brahman* said the king had hidden a valuable necklace in a pot. On digging the vessel out of the ground, the Telugu *Brahman* was found to be right. In consequence the chief punished all the *Jaina Brahmans*. His son was *Rama Bhim-esvara*, who placed one of the *Boyana* class, otherwise called *Nilam vandlu*, in charge of this village and fane; which thence acquired the name of *Boyani pùdi*. He assembled many of his tribe. Things proceeded, without interruption, down to the time of *Kulottunga Chola*. The *Gajapati* rule followed, in amity with the Mahomedans; but, enmity arising between them, one of the parties went to Golconda, and brought troops thence, which took this village. During Mahomedan rule, the privileges of the fane, and of the *Nilam* people, were taken away; but the latter, unwilling to relinquish their birth-place, took to cultivation. The *Niyoji Brahmans*, at a subsequent period obtained exclusive privileges.

Section 3. Account of the forest of *Chinna puvu tena*, in the *Rajamahendri* district.

Reference to an extensive forest of twenty Indian miles (about 25 English) in extent. Not far off is the sea. There are vacant spots in the said forest, where cattle were fed. Various particulars are added as to the production of the forest; especially a particular kind of honey, produced by bees feeding on the *Chinna puvu*, a kind of flower. This district is under the zemindar of *Pit'ha-pur*.

Section 4. Account of the *Amildars* (or rulers) of the *Rajamahendri* Circar (the *Chalukiyas* and others).

Anciently the *Chalukiyas* ruled; of whom *Cubja-Vishnu-Verddhana* is first specified. Thenceforward is deduced, in brief, the following:

List of Chalukya, and other Kings.

Vijaya aditya, 48 years.

Vishnu Verddhana, 12 years.

Vijaya aditya Chalukya, 44 years, founder of *Rajamahendri* fort, &c.

Bhima, son of Vicramaditya and nephew of Vijaya aditya.

Amma-raja, 7 years.

Vicramadityan, son of Bhima, 11 months.

Chalukya raja, 7 years.

Bhima maha raja, 18 years.

Amma raja, a short time.

Dhana Bhupati, 3 years : in his time the Chola king came and captured the *Vengi desam*, and ruled 27 years. Afterwards of the Chalukya race—

Kirti verma raja, 12 years, re-conquered *Vengi desam.*

Vimaladitya, 7 years.

Raja Narendra, 40 years, Sarangadhara was his son, concerning whom the Sarangadhara Cadha was written.

Rajendra Chola, 15 years.

Vicrama Chola, 5 years.

Kulottunga Chola (no time stated), name of dynasty.

Pritisvara maha raja, 35 years.

Mallapa devá, of the Chalukya race 10 years (SS. 1124).

Annaiya deva, of the Surya race, 30 years.

Annaiya deva bhupalan, 30 years.

The Reddi-race followed.

Potaiya vema reddi,

Anupota vema reddi,

Dherma vema reddi,

Comti vema reddi,

Raja vema reddi.

These ruled during 100 years; the country then came under the *Gajapati* ruler, in the time of *Vira Narasinha Langula.*

Pratapa Rudra.

Mukunta deva.

Raja vidyádhara.

Notice is then given of an extensive grant, by way of privilege, made by the *Gajapati* prince to a *Niyogi Brahman,* leading to an extensive diffusion of that tribe in the *Rajamahendri* district. A few minute details bring the account down to the Mahomedan conquest of Warankal.

Remark. This list is not so full as that in section 7, of M. S. book No. 10 foregoing. Both lists require to be translated, and compared.

According to the index of contents prefixed to the book, there should be a fifth section, containing an account of *Vamagiri,* a hill fort in *Rajamahendri* Circar, but this paper is not now contained therein. The

name of *Yoma giri* appears in section 4, as that of a capital or fortress of the *Chalukyas*; but the whole account is contained in one paper.

General Observation.—This book was so much injured by insects, that I doubted the practicability of its satisfactory restoration. The patient labour of a copyist has however been tolerably successful. In a few places, of necessity, words are lost. The contents are of value; chiefly so the 4th section. The 3d section is of the least consequence.

Manuscript book, No. 41—Countermark 731.

Twenty five tales of the *Vetala*, related to *Vicramaditya.*

This is a version of these popular tales, stated to have been obtained in the Telinga country. It is superfluous to make any abstract, because sufficient notices, or full translations, of them have been already published. This book is damaged at the edges, by damp and termites; but the writing within is only very slightly touched, and the ink is good. It will last for some years; though its preservation is not of consequence. The book is entered in Des. Catal. vol. 2, p. xxiii.

MS. Book	No. 14,	C. M. 704,	Des. Catal. vol. 2, p. vii	art. 14.
Ibid............	,, 16........	,, 705	Ib. vol. 2, p. vii,	art. 16.
Ibid............	,, 17........	,, 707............		art. 17.
Ibid............	,, 18........	,, 708............		,, 18.
Ibid............	,, 20........	,, 710............	p. ix,	art. 20.
Ibid..........	,, 23.........	,, 713............	p. x,	art. 23.
Ibid............	,, 24........	,, 714............		art. 24.
Ibid.	,, 25........	,, 715............		art. 25.

These books are thus briefly classed together, because their contents are similar, and of trivial or no importance; being merely minute lists of accounts, or revenue proceeds from various *caranams*, or local subdivisions, of various districts in *Telingana.* The reference to the Des. Catal. will afford the respective indices of contents, prefixed in English to the several books; only in making any such reference care must be taken to observe, that the English having been written by a native, the phrase " particular account" must not be misunderstood to mean any connected statistical narrative; but merely detached lists of places, and revenue, as an accountant would make entries in a ledger, or similar book. Any attempted abstract would be impossi-

ble; if possible, useless. In general the paper and ink are in sufficiently good preservation.

Manuscript book, No. 33.—Countermark 723. Des. Catal. vol. 2, p. 16, art. xxx.

Account of allowances to the fane of *Calahastri isvara* in Telingana.

This, like the preceding, is merely a list of numerical accounts, differing only in subject; which, in this instance, relates to allowances made from revenue proceeds to the *Saiva* fane at *Calahastri*; a place of considerable repute about 40 miles N. of Madras. The paper is in tolerable preservation, the ink good: the document will last several years.

Manuscript book, No 52.—Countermark 742.

It contains a journal of *Mallaiya*, from January to December 1814, in his journey through the Ganjam district; is written in Telugu; and is in tolerably good order, though touched here and there by insects.

Manuscript book, No 53.—Countermark 743.

A continuance of the same person's journal, in the same neighbourhood, for the year 1815. It is a little more injured by insects, than the foregoing; but perfectly legible throughout. Neither of these two books require any further observation.

C. MAHRATTI.

Manuscript book, No. 61.—Countermark 858.

Ancient record of *Nandivaram*, containing an account of *Nandan Chacraverti*, and of the thirteen tribes of *Nandivani Brahmans*.

To the north of the *Vindhya* mountains is the *Ariya bhumi*, or sacred land: in it are the Ganges, the Jumna, and other rivers; it was the residence of *Brahma*. The *Brahmans* came from his face. To the

south of the *Vindhya* mountains is the *Dandacáranya,* in which *rácshasas* and others, resided. As the *Dandacáranya* was vicious *(páva bhúmi* opposed to *punya-bhúmi* before specified), so it was very lofty, or elevated. The *Vindhya-asura,* by severe penance, had acquired great power, so as to trouble gods and men; and the *Brahmans* complained of the interruption of their daily sacrificial ceremonies, to *Agastya,* who carried their complaints to the presence of *Brahma;* further representing that since there were no *Brahmans* in the *Dandacáranya* it would be expedient to create more of them, and locate them in that land. In consequence of this request, *Brahma* created the following classes of *Brahmans.* 1 *Andhra,* 2 *Mahrashtra,* 3 *Drávida,* 4 *Carnata,* 5 *Gujra;* these forming the *pancha Dravida* (or southern class) were directed to go with *Agastya,* and remain in the strange land; while the 1 *Mânava,* 2 *Cúbjaya,* 3 *Canójya,* 4 *Ragada,* 5 *Gauda* forming the *pancha Gauda* (or northern class) were to go with *Agastya,* but to return. *Agastya,* accompanied by the *Brahmans,* proceeded to the *Vindhya* mountain, where the *Vindhya asura,* with his disciples came to pay him respects. *Agastya* told him that he himself was going to the south on pilgrimage; and directed him (the *asura*) to stay in this place, with his people. *Agastya* then, holding his water vessel in one hand, struck the mountain with his pilgrim's staff held in the other hand, and by doing so levelled it. He then directed the northern class of *Brahmans* to return; and, taking the southern class with him, he proceeded to the south. From that time the *Dandacaranya* ceased to be the abode of *Racshasas.* The five divisions of the southern class of *Brahmans* gradually filled the southern countries, and many towns were built therein; while the northern class of *Brahmans* retained their possessions in the north.

* * * * *

(In this place three leaves are cut out from the book).

In Cali yuga 2604 *Nandana Chacraverti* reigned over a vast extent of country, in a town called *Nabavar.* One day a religious person from the company of *Agastya,* came to that town; and, in consequence of civilities received from the king, taught him a *mantra* (or charm) by the use of which he possessed the power of proceeding whithersoever he wished in a short space of time. Possessed of this power he daily visited *Gaya* (the celebrated place of pilgrimage); and his wife, after some time, also accompanied him. Receiving some civilities from a *Brahman,* at a place where they halted by the way, he made the *Brahman* a magnificent present, and encouraged him to expect more, should the said *Brahman* visit the king's territory. The *Brahman,* encouraged by the promise, engaged five hundred other householder-

Brahmans to accompany him; and, with them, proceeded to the presence of the monarch, claiming a performance of the promise; which the king was disposed to refuse; but on the *Brahman* bringing the *svami* (*Siva*) and *Devi* (*Parvati*) as witnesses, the king joyfully fulfilled his engagement, by giving a large town, in free tenure, to the *Brahman* and his associates. As the *Brahman* considered the favour of *Devi* to be the cause of this splendid acquisition, he built a fane, with the usual accompaniments to her honour, and, for her worship. While the *Vedas*, and other books, were being read in that *agraharam*, as usual, a young *Brahmachari* went from it, and asked from "the *Rayalu*" a marriage-present. The king told those around him to examine, and report, on the circumstance; and these, stating that the residents in that *agraharam* were all stupid people, recommended a public examination of the young man's learning. In consequence he performed penance to *Devi*, who satisfied therewith, directed him to go to the examination without fear. He did so; and having passed it, received from the monarch the present which he had sought.

(Here the book ends; apparently without a proper close. It is in tolerable good order; and does not call for immediate restoration).

Remark. By means of this book I have been enabled to understand the *pauranical* fable of *Agastya* having "humbled the pride of the *Vindhya* mountain." It is nothing more, nor less, than a symbolical statement of the first immigration of the *Dravida Brahmans* into the Peninsula, from the north; where they had earlier obtained a footing. Once understood the symbol is easy and natural. It is a subject of frequent allusion, in various *Hindu* compositions. Originally the *Brahmans* were most certainly foreigners to the Peninsula. To know that, is one important step in tracing their remoter origin.

The cutting out of three leaves, containing an account of "the obscure *Nandi-varam* dynasty" is a fault attaching somewhere; and it greatly deducts from the value of this manuscript.

Manuscript book, No. 20.—Countermark 932.

Section 1. Account (or local legend) of the fane of *Sri-kétha tanda* at *Pandarpur*.

Reference to the fault committed by *Chandra* (according to the *Puranas*); in consequence of which his preceptor denounced on him a punishment of loss; and upon *Chandra*, enquiring when the fault would be

expiated, his preceptor gave him a staff (*Kêthatanda*) with directions to dip it in the *tirt'has*, or sacred pools, which he might visit in his pilgrimage; and in whichsoever it should remain, so as not to be capable of being drawn out again, in that pool, by means of bathing, the fault would be removed. According to these instructions, *Chandra* acted; and on dipping his staff in the pool at *Yálimarjuna*, in the *Dandacaranya*, it remained immoveable; and he was released from his spell-bound situation. The writer of the legend refused to call the pool the *Chandra tirt'ha*, but named it *Kéthatanda tirt'ha*; and sung its praises in the twelfth *adhyaya* or section, of the local *purana*. At that time there was a small village near the spot: in which a *Brahman* named *Pundarica* had built a small hut of dry-grass and reeds; and lived therein, with his relatives and family. As many people passed by, going on pilgrimage to the Ganges, he became affected with a desire to do so too; and proceeded from home, for that purpose. He came as far as a place called *Chittra cúdam*, where he lodged in the house of a *Brahman;* and asking him how far it was to the Ganges, the latter replied he did not know. In the morning the Ganges, Jumna, and *Sarasvati*, in the shape of three females, came and performed all needful household work for the *Brahman* host; and, learning from the pilgrim his purpose, told him that they came hither every day. (A mere allegory to imply the use of water in household affairs). The pilgrim-*Brahman* now judged it his best course to return home, and provide for his aged father and mother. On returning, he found them fainting for want of nourishment; but they revived on his return. While engaged in supporting them, *Nareda*, unknown and unobserved by the *Brahman*, came and saw his filial piety, which he reported to *Crishna*, then residing in *Dwaraca-puram*, who was so much struck with it, that he went himself to see it. Soon after he had witnessed the *Brahman's* filial care, the parents of the latter died; and then *Crishna* identified the body of the *Brahman* with himself (i. e. the *Brahman* died). In consequence of *Crishna's* absence his wife *Rukmeni* sought him in many places; and at length found him at this one. Fanes, shrines, &c. connected with them having been built, *Crishna* then took leave of absence; saying he was going away to perform the *Varáhavataram*, and in consequence of his leaving the place for that purpose, it became termed both *Panri-nat'ha*, and *Pundiri nat'ha* (the latter apparently indicating the *Brahman's* name, and *Panri* meaning, in the common dialects of India, "*a pig*;" *Panri-nat'ha*, being equivalent to *Varaha-svami*).

A Nizam made great benefactions to the fane; and, at a later period when the country had come under Mahomedan rule, the revenues of the fane were assumed by them, and required to be paid into their

treasury. One of the guardians of the fane, having neglected to do so, was followed by the Mahomedans, seized in the fane, and imprisoned. The god offended at this ill treatment of his votary, withheld rain for twenty-four years from the country of the Moghuls: in consequence of which visitation they gave a jaghire for the purpose of providing the customary articles for its service; and then the god sent rain in abundance. *Sivaji*, and other Mahratta rulers, made large donations in land for the benefit of the fane, which thus became very prosperous.

These particulars concerning *Pundri-púr* were written, to the best of their knowledge and information, by *Malla-hara Bhatt*, and *Lacshmana Bhatt*, at the desire of Colonel Mackenzie, in May 1807.

Remark. This paper is curious, chiefly in a mythological point of view; but it indicates a low standard of intellectual attainment. The indirect contempt of pilgrimage to the Ganges, and the preference given to domestic piety, are however observable. The anachronism and contradiction of making *Crishna*, the so-termed eighth *avatara* of *Vishnu*, go away in order to become the fourth, as *Varaha svami* or *Panrinat'ha*, is of a different and much inferior kind.

Note.—The document is written on stout Europe paper, in unfading ink: and being also untouched by insects its restoration is not required.

Section 2. Statistical account of *Ahmednagar.*

Commodities imported and exported, periods of cultivation, and of rain—times of harvest—productions of the soil: these are minutely specified, as far as the document proceeds.

Remark. The English heading of the section also promises an account of beasts and birds; but the document in the book is not complete; and how many leaves, at the end, are wanting cannot be ascertained. It is written on very thin country paper, with indelible ink; but has been severely injured by insects. As however the subject matter is not of importance; and as the document is not complete; its restoration has not been thought needful.

Section 3. Account of *Comaradee-Shah* inhabitant of *Wastarra* 1805.

Such is the heading of the paper itself, which by the native writer of the table of contents, has been made—"Account of Camaraully Sahan of Hindoostan."

The real contents of the paper are a genealogical notice of the Ajmeer ruler, with his pedigree, from an early period.

Note.—One part of the document is complete : another one follows, on the same subject, having three leaves at the beginning but wanting the remainder. The former document, written on inferior country paper, and much damaged by insects, I have had re-copied ; since its details, such as they are, assume the shape of local history : the other fragment does not claim the same attention.

Section 4. Account of *Gujirat,* and its *rajas.*

This paper was restored in the 3d volume, and abstracted, in my third Report ; which may be consulted.

Section 5. Account of *Vicrama-raja* of *Uchchani,* or Ougein.

A mythological tale. *Parvati* is represented as enquiring from *Siva* an account of the manner in which *Vicrama* acquired the throne of *Indra. Siva* states that an inhabitant of *Indra's* world having offended his chief was sentenced to come to earth, in asinine form (symbolical) in which form the *Gandharva* married the daughter of the king of Ougein, and became father of *Vicrama,* and his brother *Batti.* It narrates the visit of *Vicrama* to *Indra* to adjust a dispute there ; for the doing of which he received from *Indra* a jewelled throne, which he brought down to earth (symbolical). After the death of *Vicrama* his conqueror *Salivahana,* attempted to ascend his throne ; but was prevented by the statues which supported the throne acquiring the power of speech, and narrating actions of *Vicrama,* which shamed his successor, and prevented him from taking his seat there.

Remark. This is a Mahratta version of the popular tale found, under variations, in all the vernacular languages of India. The acquisition of *Indra's* throne is a mere allegory to imply the possession of great prosperity. The paternal origin of *Vicrama* is variously told : in this tale it is put into as degrading a form as possible ; but still under an enigma. In other versions of the tale, *Bhoja-raja* is represented as succeeding *Vicrama,* and shamed out of the idea of sitting on that prince's throne. Here the name given is that of *Salivahana* ; concerning whom other versions of the tale offer very confused accounts. The probability is that *Salivahana* and *Bhoja-raja,* are only different names of the same

individual: this conjecture was originated by documents heretofore examined, and reported on, and may yet be confirmed to certainty. Both (if distinct persons) were of another religious system, with reference to Hinduism proper: probably of the *Jaina* persuasion; and hence much of the mystification of *Hindu* writings concerning them. The not sitting on *Vicrama's* throne is an allegory to designate building and ruling in another town than Ougein; which fact, together with a coincident change of dynasty, has been historically ascertained in the course of the preceding researches.

Note.—This document is damaged by insects; and the series of tales is not complete. Being so very common and popular a tale, many versions of which are in the collection; it has not been judged needful to have this paper restored.

Manuscript book, No. 10.—Countermark 922.

Account of Enams and Jaghires granted to the Silladars of the Mahratta army in lieu of payment for fusly year 1204 (A. D. 1795-6).

The covers of this book are much damaged, but the paper inside very slightly so, by insects. The writing is in Persian ink, and indelible. There is however very little writing on each page; and the nature of the contents, as above indicated, is such as not to claim any further notice.

Manuscript book, No. 16—Countermark 923.

" Estimate of the Aurungabad Soubah, with an account of its purgunnahs, circars, mahls, villages, revenues, &c., in the Deckhan."

This is a large book in good preservation, written on French paper, which, as appears from various specimens, insects do not seem to touch, or but very slightly. The contents might have been written in a book one third of the size of this, if filled. In this book there is merely a column running down one side of each page, which contains names and numbers. It is quite irrelevant to the leading object of my enquiries: though in itself a statistical document of some value.

Mahratta Bakheer, a roll of country paper, No. 29.

Fable of *Surpanac'ha* " a giantess."

This is a tale formed on an episode in the *Ramayana*. It is much injured by insects, and could not be successfully restored; even if it were worth the pains, which perhaps it is not.

Mahratta Bakheer, No. 31.

Account of the marriage of *Rucmeni.*

This is a larger roll of similar material, in better preservation but not complete. *Rucmeni* was a princess carried off by *Crishna;* and afterwards married to him; the tale is told in the *Bhàgavata*, in the supplementary portion, and needs no further notice here.

Mahratta Bakheer, No. 32.

Another copy of the same tale; also incomplete, and in not so good preservation.

Mahratta Bakheer, No. 33.

Account of *Sud'hauma*, a poor friend of *Crishna*, enriched by visiting him.

A roll apparently complete, but damaged. It is not of a kind claiming restoration; being a mere tale or romance.

Mahratta Bakheer, a roll of country paper, No. 27.

It is entitled in an English heading—" Modes of discourse between *Cali* and *Paricshit maha raja*;" which would erroneously lead to suppose *Câli*, or *Durga*, to be meant.

The title in the Mahratta is—A detail of the rulers in the *Carnataca-desam*, from the earliest times.

The following is an abstract of the contents.

Mana Paricshitu of the *Pándava*-race ruled down to the year 46 of the *Cali-yuga*. While so ruling, a cow, in a certain forest, was weeping on account of having three of its legs broken. A *Kirata* man (wild savage) going up to the cow, and considering that its three legs had been broken in the three preceding ages, thought it right to break the remaining leg

in the present age (or *Cali yuga*). The above king, then doing penance in the forest, saw the *Kiratan* breaking the cow's leg, and had him put into prison. He said to the king "since I am come by divine appointment why do you molest me?" The king enquiring who he was, he replied "I am *Cali* (or a personification of the *Cali-yuga*). The king said "while I am alive I allow you to do nothing." *Cali* then requested a place wherein to remain, and the king said, go dwell with * *Himsa* † *Asatyam*, ‡ *Dherma-virodha* and § *Visvásapátaca* While the king lived *Cali* gained no entrance, or ascendancy. The king had four sons, *Janamejaya*, *Sruthusena*, *Bhimasena*, *Ugasena*, who, according to this manuscript, all exercised sovereign power alternately.

Details of their rule are given, and to the second *Bhima sena* is ascribed the killing of the *racshasa*, *Jarasandha* (*Jarasandha* of the race of *Sudherma* is otherwise stated to have been killed by *Crishna*). Twenty descendants of *Bhima-sena* are enumerated, filling a space of one thousand years; they all bore the epithet of *Brahma-hatti*, from the above crime. (Possibly the writer being a devotee of *Crishna*, may have wished to shift the guilt. Moreover the names appear to be given at random, several of them belonging to a later period, and some even subsequent to *Chandragupta*). The minister of *Ribanjaya* named Munica (by *Sir* W. Jones, or by a misprint, *Sunaca*) killed his master, and placed his own son *Pradyota* on the throne. (This event belongs to the *Mâgadha* kingdom). Five successions of this dynasty occurred. In a metaphorical manner *Nanda* is said to have had no child; and his wife, in consequence, threw herself into the *Svarna-nadi* (or golden river), and by reason of doing so produced eight sons. (We know otherwise somewhat of the deposition of *Nanda*, by his minister, leading to the accession of *Chandragupta*, and by the way we may gather from the MS. in hand a useful hint as to the mode in which metaphor and allegory are made to cloud either ignorance, or the truth, as may suit the writer's convenience or caprice. To write the simple truth in simple language, does not by any means appear to have been at any time the *Hindu*-method of composition). The said eight sons, ruled during 137 years. Afterwards a female named *Sada Vrihadra* reigned, and was killed by her minister named *Chacrati*, who placed his son *Srugu* on the throne, which he held for 45 years. (This must designate the *Sunga dynasty*). The minister of *Sruga* named *Canna*, who

* Slaughter, violence, malice. † Want of truth or integrity.

‡ Opposition to equity and mercy.

§ Falling from trust or confidence; the sin of treachery.—All the terms are Sanscrit.

killed his master, and reigned in his stead, was killed in turn by *Susamas* (otherwise *Susarman*) who ruled 456 years (designating him and his whole dynasty, otherwise stated to have consisted of 21 kings). A servant killed him (his last descendant) and ruled the kingdom, and to him is given a period of 334 years. In his time (or that of his dynasty) the kingdom was reduced to great distress. About that time fourteen females of the four colours(castes) came to the *Triveni* (or conjunction of the Ganges, Jumna,* and Sarsoostee rivers) at *Prayaga*, or Allahabad. These while bathing as an act of devotion, each one had a secret wish which was sought to be accomplished. The wish of one of them was that she might have a son who should be emperor of the world. At the same time a poor *Brahman* formed the wish, while bathing and meditating the *Pranava* (or sacred name), that the said woman might be his wife. His wish was accomplished ; and their son was born at *Uchchini* (Ougein) being the famous *Vicramaditya*, who married the aforesaid four females, and ruled 2000 years. (Here again we have the *Hindu* mystic or enigmatical mode of writing; it seems to denote, what is more directly stated in other books, that *Vicrama* was the son of a *Brahman*, by a woman of inferior tribe, the daughter of the king of Ougein. The marriage of *Vicrama* to the four females, being disentangled from the possibly intentional absurdity, means that he married wives of the four tribes). Subsequently *Salivahana* fought with, and killed *Vicramaditya*. *Salivahana* ruled, on the north side of the *Narmati* (or Nerbudda) and had a son named *Mani-vahana*, and the son of the latter was *Avad'harina* : some others of the race ruled on the southern side of the Nerbudda. At that time a Rajpoot named *Gunt'hivi pati* ruled on the other side of the said river, and the Mussulmans began there by degrees to acquire power.

Subsequently *Bhoja raja* ruled in a large town (*nagara*) named *Baranagara* (in a Telugu account by *Ravipati*, the name is written *Dara pur*). —The names of eight of his decendants are given as follows :—

1. Nanda-rayalu 5 years	5. Malata rayalu 9 years.
2. Uchita-raja 5 years	6. Varada rayalu 6 years.
3. Dor-rayalu 3 years	7. Vishnu palacu 7 years.
4. Kerula rayalu 4 years	8. Tiruvapi rayalu 8 years.

These ruled over the whole of the southern kingdom ; and after them it was divided into two parts. In the *Purva Bhaga* (or northern part†), *Vira*

* *Ganga, Yamuna, Saraswati.*

† Any mention of the southern division does not appear.

Pratapa maha deo ruled over a country called *Ada malun.* The Mahomedan ruler at Delhi, acted perfidiously with the son of *Pratapa*, and took possession of the country. Some descendants of *Bhoja-raja* ruled in the country to the west, as follows :—

Pauna màli rayalu 1 year	Vil parti rayalu 15 years
Narasimha rayalu 3 years	Krivégal
Podhi rayalu 5 years	Paratu nàma chalu rayalu 6 years
Hari-hara raye 5 years	Trimisha rayalu 8 years
Ana purna raye 9 years	Chera rayalu 10 years
Yelagevi raye 11 years	Vishnu rayalu 12 years
Namivise raye 13 years	Alata giri rayalu 14 years
Chàulata raye 15 years	

in all fifteen reigns: they ruled 138 years in the town called *Baganagara.*

Subsequently some persons descendants of *Bhoja raja*, such as *Nandi rayalu* and others, ruled as follows :—

Nanda rayen,	Kanda rayal 6 years
Rama rayen, 11 years	Sauma rayal 26 years
Vira rayalu, 3 years	Kanda lada rayal 4 years
Rama rayalu, 5 years	Irávata rayal 7 years
Cutta-nadi rayen 8 years	Sindhi d'hana rayal
Chaya muttu rayen 10 years	Vira vasata rayal 12 years
Chanda rayen 13 years	Búka rayal. 14 years.

In all fourteen persons, who ruled in *Dara nagara*, but at the same time suffering from insufficient means and privations. At length many other persons took away different portions of their kingdom. The violent partition occurred in Sal. Sac. 987. A. D. 1065.

Afterwards one named *Vindhya ravu* performed a penance on the hill of *Sri Sailam* to *Devi* in order to obtain wealth ; whereupon the said goddess appeared to him,and told him his wishes could not be accomplished in the present life ; but would be granted in a future birth. He increased the severity of his penance, when *Devi* again appeared ; and gave a small district around the site of *Vijayanagaram.* The names of his posterity (being the *Rayer* dynasty) are given as follows :

Deva rayal	1 year	Gopa rayal	4 years
Hari hara rayal	3 years	Chokanda rayal	
Buka rayal	5 years	Hatti-rayal	6 years
Képa rayal	7 years	Chaimutu rayal	8 years
Cumal keta rayal	9 years	Kumbalata rayal	10 years

Being in all ten rulers; the termination of their dynasty was in Sal. Sac. 1350 (A. D. 1428). They ruled in all 350 years.

Afterwards *Vira Baktala raye* was seated on the throne at *Vijayanagaram*, in Sal. Sac. 1391. Subsequent to him the country came under the rule of the Mahomedans, and other various persons. Here the manuscript refers to a former communication, and adds that the account was drawn up in compliance with the wishes of MajorMackenzie; but it has no date, and does not give the name of its author.

Note.—This document being a mere roll of country paper, already partially damaged by insects,and liable to early and rapid destruction was restored, on ascertaining the nature of its contents. The absurd English heading could have induced no one to suppose those contents to be of any value. As the case now is, the question is as to authenticity. Some matters at the outset throw a doubt upon the subject. We have accounts of the *Mágadha*, and subsequent, dynasties, in which there are minor differences from this; still the main outlines are preserved, and are in both the same. The list of kings of *Vijayanagaram*,a few names being excepted, differs from the more usual lists, and the names are fewer in number. These considerations are stated because of the very great importance—if authentic—of the middle portion of this manuscript. Of that portion, from the mention of *Salivahana*,down to the violent partition of the *Dara-nagara* country, the account herein given is a translation. Should this portion be authentic, and be proved to be such by other documents, then, so far as my knowledge extends,a chasm in a part of the past history of this country will be in some measure filled up. But I hesitate as to resting more weight of confidence on the document; previous to further confirmation of its statements. The Mahratta language is calculated from the locality of its usage to give more information on that period, and concerning that neighbourhood, than any other; the Gujeratti, or Hala Canada, perhaps being alone excepted.

Manuscript book, No. 10.—Countermark 876.

Section 1. The *Sť'hala-puranam* or local legend of *Sangama-Cshetram*, at or near *Chunchuna* in the division of *Yeli* in Mysore.

In ancient times a *rishi* named *Trinabindhya* was doing penance, when *Vishnu* appeared, and told him he could not yet obtain beatification; but that when he *(Vishnu)* came hither as *Rama* then that gift should be bestowed. About the same time a *Kirata-man* (or savage) was labouring to get wealth, when the *rishi* advised him to cultivate the *tulsi* plant, that when *Rama* came it might be used in his service. The *rishi*, and savage, both received gifts from *Rama*. The *rishi* obtained leave to remain at this place, and to build a shrine, with an image of *Rama*, which he accomplished.

A *Pandiya* king having greatly troubled the "divine *Brahmans*," and being greatly afflicted in consequence, travelled to different places on pilgrimage, to get rid of his visitation; and at this place the god met him in the form of an old man, and directed him to build a fane, which he did. This fane having gone to decay was repaired by *Hari-hara-rayer*.

Nareda having visited many places went to *Cailasa*, and there enquired of *Siva*, an account of their origin. Some *Pauraunic* references are introduced, as if stated by *Siva*. There would seem to be a reference to a *Saiva* fane at this place; but the reference is not clear, owing probably to the legend not being complete.

Note.—Though the paper on which this section is written is damaged, yet it does not seem to be worth restoration.

Section 2. Account of *Periapatnam*.

Such is the title in the English heading of the section, and a similar one is written at the commencement of the manuscript. The cause of such a title seems to have originated in the manuscript having been copied (as stated at the end in the Mahratta subscription) from earlier documents by *Narrayana Bhatt*, and *Capavi-Bhatt*, living in *Periapatnam*, and supplied through their instrumentality to the collection.

The contents of the document trace the genealogy of *Raja-Crishna-Udiyar* of Mysore, up through the *Rayer* dynasty, and some intervening races, to *Bhoja-raja* and preceding kings as high as the era of *Yudishst'hira*. But in its order it follows the descending series.

It commences with the mission of *Agastya* from *Cailasa*, his reducing the *Vindhya* mountain, with an obscure reference to the king of the country southward, whom he rendered harmless; * and his going on pilgrimage towards the south. The subject is then confined to the *Caliyuga*. The era of *Yudishst'hir*, with inclusive reigns, is given. The era

* Compare with abstract of No. 27 in the Mahratta portion of my 3d Report.

of *Vicramaditya*, and of *Salivahana*, down through *Bhoja-raja*, the *Chalukyas*, the rulers of *Deva-giri*, the *Rayer* dynasty, to the royal line of the native *Hindu* sovereigns of Mysore.

NOTE.—The chronicle is but brief; though relating to a great extent of time. Being damaged, through damp and insects, I have had it restored; since it is a document of some considerable importance; and as such it ought to be fully translated.

Section 3. Account of the *Irucknath* religion in the Mysore country.

This paper offers nothing, beyond some local regulations for different classes of people, in visiting the shrine of a local *numen*, at a place termed (by accommodation) *Curucshetram* in Mysore. It is not in very good order; but does not seem to be worth restoration.

Section 4. Account of the *Câpâla* religion in Mysore.

This paper relates to the shrine of a goddess named *Capala-matri*, in the same neighbourhood, being a local form of *Devi*, or *Durga*; and is chiefly occupied with panegyric on the said image. It is of no valuable consequence.

Section 5. Account of the fortress of *Balala-rayadurga*, at *Coppahobhalli* in Mysore.

This is a short account of *Roydroog* (or Royacottah as we now commonly term it). Its origin, in this paper, is ascribed to one named *Bakhtala-raya*, under the following circumstances. A *Jaina* ascetic greatly troubled the people of the neighbourhood; and the said *Bakhtala*, professing to become his disciple, did homage at a shrine of *Rama*, and by virtue of that penance acquired the power of killing the ascetic; and, for so doing, the people gave him rewards. With the measure of wealth so acquired, he gathered people around him, and plundered: by the accession of means so acquired, he further strengthened himself; conquered an extensive district: and first built the fortress of *Rayadurga*. He was named *Deya-vina-athi-raya*; and he had three sons named *Bakhtala-raya*, *Vishnu-verddhana*, and *Deya-vina-raya*, of whom the first

was a *Saiva*, and the second a *Vaishnava*. At an early period the place seems to have been subjugated by the Mahomedans; and some mention occurs of changes under their rule.

Note.—This paper appears to be an imperfect account of the origin of the *Oyisala* dynasty, which ruled at *Hobhalli;* and was at one time of considerable consequence. The paper is brief; complete as far as it goes; and being somewhat damaged, has been restored, for its better preservation.

Section 6. Account of *Chandragupta-cshetram*, in the province of *Bidanur*.

A legendary reference to the sacrifice by *Dacsha;* the self immolation of his daughter: the anger of *Siva*, her husband; and the formation of *Vira-bhadra* in consequence. The paper is incomplete, and seemingly worthless.

Section 7. Legend, or *St'hala-purana* of *Killadi.*

This is a mere local legend; apparently of little or no consequence.

Section 8. Account of *Halla-bede* in *Bidanur*.

This paper entitled as above, in the English heading, is another, and fuller, account of the *Balala* rulers at *Rayadurga.* The like account, as in a former paper, is given of the killing of a *Muni*, herein termed a *Saiva.* The account of the posterity of the founder of the dynasty is more full, than in that paper (sec. 5), and it is herein stated that as one part of that posterity was of the *Saiva*, and the other part of the *Vaishnava* persuasion, they fought with each other. One of the race was cured of leprosy by building a great many *Saiva* fanes. Another of the race, marrying a Mahomedan woman, was driven away by his father. He went to the Padshah, who came and took Roydroog; and, causing the before expatriated son, to be crowned at *Vijayanagaram*, he placed him as feudal chief at Roydroog. A list of his descendants, and details of their wars, with other proceedings, follow.

Note.—This paper being much damaged by insects, and damp, has been restored; and it merits full translation, as a valuable document, relative to the *Oyisala* kings.

Section 9. Account of *Copam* in *Bidanur.*

A reference to the anger of *Siva* in consequence of the self immolation of his wife, at the sacrifice of *Dacsha;* the place receiving its name from that circumstance, as if it had occurred there. A *Saiva* named *Cópa*, built there a hut; and afterwards *Jina Danda-raja* made it a metropolis, building a fort there. Having no offspring he gave it to a *Brahman.* *Siva-danda-nayak,* afterwards ruled. A few other names are mentioned; who, by their cognomens, would seem to have been *Brahmans.*

Note.—The document is much damaged; and, as it may have some historical value, it has been restored.

Section 10. Account of the *Cáveri,* in the *Cannaba* district.

The account of the *Caveri* is only promised, but not given. It is little better than the legend of a fane; chiefly having reference to a leprous king, who, it may be anticipated, was to lose his disease by bathing in the *Caveri;* but the document is unfinished, and appears to be of no importance.

Mahratta Bakheer, No. 23, a roll of paper.

This document is incomplete, both at the beginning, and the end. From the remaining middle portion of the fragment it is found to relate to revenue, and other, details of the Peishwah. His treasurer had made false accounts; and, these being detected, he was summoned to follow the Peishwah to a place whither the latter annually went on pilgrimage. The treasurer did not do so; and forcible measures were resorted to, in order to compel his attendance. There are further some details of marches, and mention of some towns, or places, taken.

The document is damaged by insects and damp; but as being a mere fragment, and without matter of permanent interest, its restoration has not been deemed requisite.

Manuscript book, No. 5—Countermark 917.

Contents. A short account of the revenues of the fifteen Soubahs in Hindustan, under the government of Acbar, Padshah of Delhi.

This book has but a slender proportion of matter compared with its size. It is written on French paper, and is in good preservation. The subject of course is incapable of being abstracted; and the contents in themselves are brief. As a statistical document it can at any time be referred to, if requisite.

Mahratta Bakheer, No. 28.

A large roll of paper "Genealogical account of *Malogi* and *Vitogi Bhosala*, princes of the Mahratta dominions."

This document has the beginning; but is not complete at the end. As far as it proceeds it contains a somewhat full and curious detail of the origin of the Mahratta chiefs from *Babaji Bhosala;* whose two sons *Vitogi*, and *Malogi*, were soldiers of fortune. Their adventures and services are mentioned, especially under the Delhi Padshah; until, by an adroit use of circumstances, their descendants became princes.

The important part acted by the Mahrattas might perhaps render the genealogical detail worth full translation. The document is in tolerably good preservation, with a slight exception at the beginning; and its restoration does not seem to be urgent; though it may possibly hereafter claim attention.

Mahratta Bakheer, No. 8—Countermark 920.

A roll of country paper, entitled "Genealogical account of *Nanah Saheb* of the Peishwas."

This document contains a rather full historical detail of the branch of the Mahrattas, established at Poonah. At the beginning *Appaji* Saheb is represented as enquiring into the past history of his race; which is narrated to him by the author. At the close, a copy of this document is said to have made, by special request, for Major Mackenzie. The roll of paper is a large one; and it is surprising that the matter should have been written on such a fragile material. It is damaged in various places, and words are eaten away by insects. The matter however is for the greater part recoverable, and the document is complete. For these rea-

sons, and especially from viewing the details to be of considerable consequence, the document has been restored; and I am of opinion that it merits full translation.

Manuscript book, No. 19—Countermark 885.

Account of Hyder-Nayak.

This is a small book, and contains chiefly statistical details. It gives a statement of the towns, or places, conquered by Hyder Ali; amounting to one hundred and twelve. There is a detail of the strength of his army, with the number of his cannon and muskets. The names of his ministers, and officers holding official or revenue charges, are given; and a statement of the districts, or towns, wherein they exercised their various employments. It is dated in April of the *Crodhana*-cycle-year; but without a more definite date.

The book is somewhat injured by damp, and a very little by insects; but the writing throughout is perfectly legible, and restoration does not seem to be required.

Manuscript book, No. 12—Countermark 878.

Section 1—Memoir of Hyder Nayak.

This paper contains a somewhat lengthened account of the life and actions of Hyder Ali; but it is not complete, breaking off abruptly.

His origin—family connections—rise from obscurity, in being made a commander of 2,000 cavalry—are mentioned; and the various steps are then detailed by which he acquired additional power, and set aside his former master; the wars in which he became engaged are specified. The abrupt breaking off is at the period of an interference with the Coimbatore province; at which time he was sixty years of age.

It does not seem necessary to make a minute abstract, seeing that the general events of Hyder's life are tolerably well known. A translation in full might nevertheless be curious. The document is written on French paper, which insects do not touch, and the ink is permanent; consequently nothing further is needful to be done with it for the present.

Section 2.—Account of *Siva Samudram.* This is a legend of a district, with its fanes, not very far distant from Seringapatam.

The origin is dated beyond the era of *Rama-Chandra* who, it seems, visited the spot, when dwelling in the wilderness. There does not appear to be in it any thing of importance. The papers concerning Mysore seem to agree in stating, that *Rama* went by way of the Mysore country to *Lanca.*

The document is in sufficiently good preservation ; but it is not complete, and breaks off abruptly. A pencilled memorandum by Colonel Mackenzie dates its receipt by him in 1800.

Section 3.—Memoir of Tippu Sultan.

This paper commences with a reference to the siege of Trichinopoly. The presence of *Nanda raja* of Mysore—the capture of a province—the power acquired by Hyder—the intention of the latter to capture the town of Madras—his negociation with the Mahrattas of the Peishwa to keep them off—and the pecuniary terms on which they consented to be bought off—are narrated. The document is then somewhat full in its details of Tippu's operations; chiefly against the English. His conduct at Vellore—his ill-treatment of his prisoners—alliance with the French—are stated. Affairs at Trichinopoly are detailed. The document breaks off abruptly, without a proper close.

Note.—It is written with permanent ink on French paper, is quite uninjured, and can be easily made the subject of reference. By consequence it claims from me no further attention. It is endorsed in Colonel Mackenzie's hand-writing—"Life of Tippoo Sultan from Colonel Close, September 7, 1800."

Section 4. Account of Budda Ballapur in Mysore.

This document relates to a district locality, of which the proper name seems to be not Ballapur, but *Bakhta-puri.* In fusly 948 (A. D. 1539-40) three individuals of the *Canchi* district, unable to support the distress (cause not stated, but most probably the *Rayer's* invasion) fled from that country, and went above the *Payinghat,* where they constructed huts to live in. While there some other individuals, subjects of the *Rayer,* returned from a pilgrimage to *Ramiseram,* and lodged with the new settlers. Three boxes came down the river; on opening which they were found to contain images of *Nandi, Narayana* and *Gopàl.* The finders made their supplications; and, in the night, a vision appeared

directing them to abandon these huts; pointing them to a place where buried treasure was to be found; and directing them, with it, to build a town and fanes. They followed the directions given; obtained the treasure; and came to an open plain where formerly a *Jangama* shrine had been. Here they determined to remain. They accordingly built a (mud) fort, with a town, and repaired the old *Jangama* shrine. The leader is termed, *Baktipuri*-sultan, who acquired the power of a local chief, and transmitted his authority to his descendants. After some time the place was captured by the Mahomedans; subsequently by the Peishwa's Mahrattas; and still later by the English.

Note.—The locality is I believe on the western border of the Mysore country. As a local paper it is of some value. It is in a perfect state of preservation.

Manuscript book, No. 9—Countermark 875.

Section 1. Account of *Asubjah* (Asuphjah) Nizam-ul-moolk, collected in Mysore.

This paper wants eight half sheets at the beginning, and is not complete at the end. It contains a statement of the Nizam's proceedings at Delhi, and in the south; mentioning the places subdued, or brought under him, and paying tribute. There is a full specification of his officers, civil and military, and of the districts controlled by them. Mention is made of Monsr. Bussy, and of the interference of the French, in the affairs of that part of the country. A combination of various powers was formed; in which Hyder, the Peishwa, the Guicovar, and others, were concerned; who fought with the Nizam, and took Hyderabad. Some other affairs with Delhi, and wars; in the midst of an account of which the document abruptly breaks off.

Note.—It is written on good French paper, with permanent ink; and is in perfect preservation, though incomplete.

Section 2. Some account of *Anagundi*, collected in Mysore.

This paper relates to a period subsequent to the overthrow of the *Rayer's* power. A Mahomedan collected a few people; and pretended that he was authorized from Delhi to assume the feudal principality of

Anagundi, of which the shadow of royalty there, being afraid, bought him off with a sum of money. On a subsequent reference to Delhi, the ruler there disclaimed any knowledge of the transaction, and any intention to disturb, the *Hindu* prince in the possession of his fief. On learning this circumstance, the said *Hindu* ruler became greatly incensed, and, wreaked his vengeance on all whom he could lay hold of, that had been concerned in the plot, and imposition, practised upon him. A list is given of the persons whom he put to death.

Note.—The document is uninjured.

Section 3. Account of *Hastinavati* or Delhi.

This is a brief statement, commencing with the era of the *Cali yuga*, and coming down to the time when the name was changed to Delhi, with the mention of some kings. *Salivahana* and *Bhoja-raja*, are adverted to, as distinct persons; and, after the latter, *Kailasa-raja*, which seems to be a titular name.

Note.—The document does not appear to be of much consequence; and it remains uninjured.

Section 4. Account of the arrival of Tippu Sultan, at *Devanahalli.*

A very short, and unfinished, paper; containing a memorandum of some of Tippu's proceedings; but breaking off abruptly, and of no value.

Section 5. Account of a tobacco contract with Tippu Sultan.

Notice of a farming transaction. *Tippu* leased out lands to cultivators of the tobacco plant, on certain conditions; whereby he obtained a considerable revenue.

Section 6. Some account of the settlement of Tippu Sultan.

According to this document an attempt was made to establish what is now called the *ryotwar* system of cultivation, which failed; so that the system of *mirasidars*, or *zemindars*, was re-established. Some

other mention of revenue transactions; in the investigation of which Tippu was greatly incensed, and hanged two of the principal persons concerned.

Section 7. Account of *Bijnagara* collected in the Mysore country.

The commencement is legendary. A Brahman unable to sustain the pressure of a famine which prevailed, did penance with a view to obtain wealth. The god at first refused his request, but afterwards granted it, when he had no longer any desire for it; so that he bestowed it on a *Cshetriya*, or *Rajputra*, who built a town, and made himself a district chieftain. At a later period transactions in which Mahratta generals were concerned occur: but the narrative breaks off abruptly.

Note.—This document is written in pale ink, and is slightly damaged. As there is something of real history contained in it, I have had it recopied.

Manuscript book, No. 22.—Countermark 934.

Section 1. Account of *Calikapuri*, and of *Bhoja raja.*

Reference to the *Pandava* race, down to Sal. Sac. 58, when *Bhoja-raja* ruled. He conquered in the north, and erected a pillar of victory (*jaya stamb'ha*). To the south the *raja* of *Cambhira* averted an invasion by submission. *Bhoja-raja* ruled in *Calikapuri*, and made great addition to its fanes, and other buildings, including seven *Saiva* fanes. He ruled down to Sal. Sac. 124, with great celebrity. Subsequently *Ranga-Yadava rayalu*, with his successors, and the Delhi Padshahs, with their successors, are given in detail. The narrative comes down to the period of a war between the Delhi Padshah, and Hyder Nayak; with the mention of which the document ends.

Note.—This manuscript appears to be of considerable value, and meriting full translation. At present the writing is in good preservation. The material written on is country paper, which insects have begun to attack chiefly in the margin. The document will require to be kept in view, and to be looked at occasionally; but its restoration is not at present of urgent necessity.

Section 2. Tale of *Vicrama,* prince of *Uchchini.*

This is one of the popular tales concerning *Vicramaditya.* It is in a rather more deteriorated condition than the preceding section; but there is nothing in the tale to merit the process of restoration.

Manuscript book, No. 36.—Countermark 948.

Contents. Another copy of the 25 tales of the *Vetala.*

With a few slight exceptions at the beginning, and at the end, this book is in tolerably good preservation. It is a version of the tales of *Vicramaditya's* attendant-demon, or *Vetala.* They deserve no serious notice in researches of the present kind, and it is to be regretted, that the commonness and popularity of such kind of tales, have a tendency to detract from the general value, such as it is, of Hindu literature. A vitiated, and morbid, taste can alone be gratified by such kind of productions; and they convey a low estimate of the people among whom they are popular.

Manuscript book, No 5.—Countermark 871.

Section 1. Account of *Muluvacal* in Mysore.

The account was written in May 1837, from the statements made by *Asaman* the *Amin*; *Kalla rao* the *Serishtadar*; and others. The statement is wildly legendary. The ancient name of the place was *Mat'hapur.* It was visited by *Rama* and *Sita*; and was chosen as a suitable place for the penance of *Valmica.* In the time of the great war, *Hanumàn* assisted *Arjuna;* and the latter greatly admired the former's bravery. The hill in the vicinity afforded a refuge to the *rishis* during that war. At a later period many fanes were built here, as the spot was esteemed sacred. Its subjection to a native prince is stated; and its subsequent assumption by the Mahomedans. Towards the close of the paper there is a reference to the war against Tippu, conducted by General Harris, Colonel Close, and others; in which war Tippu was slain by a cannon shot, and his country was taken.

Remark. The paper being written down from verbal statements, and being of a legendary character, does not seem to offer much of conse-

quence. It is very legible; and the paper but slightly injured. Hence it is passed by, without any further attention.

Section 2. Account of *Chandradrona* hill, or *Vayvu-parvatam*, in *Bidanur*.

During the residence of *Rama* and *Sita*, in the wilderness, *Hanumàn* went as far as *Nasica* (Nassuck), to see them. After the abduction of *Sita*, the said *Hanumàn* sought every where through the south, in the caves, and hills, in order to find her. Among other places he came to this hill; and gave it a name. During the war, when *Hanumàn* carried a mountain through the air he let fall a portion of it here, which hence became named *Chandra-drona*, after its original name, in its former site. The sound as if of singing is heard within it. It was waste during the *Dwapara-yugan*. At a later period it became a *Jangama* fane. There is some similar legendary matter, about *Crishna* and *Arjuna*.

Another account of the same hill.

The same tale of the falling of a portion of the mountain carried by *Hanumàn*.

NOTE.—The damaged state of this paper would have indicated its restoration, if worth it, which seems not to be the case. As a passing remark, the great influence exercised by the *Ramayana* and *Mahabharata*, may be noted, and must frequently have been observed in foregoing portions of these abstracts. The wildest inventions, when grounded on incidents mentioned in those poems, seem, every where in the south, to be received with implicit credulity. No doubt this hill, termed *Vayavu-parvatam* or "the hill of wind", must have something remarkable about it. I regret the want of local knowledge concerning it, on grounds quite different from this legendary fable.

(*Section* 3. to 6, in the Canarese language; omitted under the head of Mahratta writings).

Section 7. Account of *Shahuni* or *Hossein-pur*.

The original and legendary formation of the place is ascribed to *Shakuni*, a woman of the *Caura* tribe, who provided curds for the five *Pandavas*. At a much later period a chief, named *Vira-bhadra-nayak*, cut down the wood, cleared the ground, and established a colony, building a

fane to *Vira-bhadra*, the titular *numen* of his tribe. Still later the town, and district, came under the government of Tippu; when its name was changed to Hossein-pur.

Note.—The document is in sufficiently good preservation.

Section 8. Account of *Vitala-pur*.

A reference to *Magada-desam*, and the mention of a few names and incidents, when the document abruptly breaks off, without the promised account of *Vitala-pur*, which it may be conjectured, was to arise out of it. That *Magada-desam* (not *Mágadha*) was above the ghauts, in the province now called Bidanur, is a little point of geographical information, helping towards an explanation of the fifty-six countries of the *Hindu-puranas*.

Section 9. Account of *Nanda-ram*, an aged man of the *Rajputra* caste at the village of *Tanchar* in *Bidanur*.

He was originally of *Joudhpur;* his family being gold and silver smiths. He followed the army of a Padshah, as a sutler; supplying pease and wheat, for horses, and men. He afterwards became employed by Hyder Ali, and was sent to Masulipatam. Some mention of Hyder Ali's relations is added.

Note.—It is difficult to say what could have led to suppose a biography of such a person to be of any consequence. It seems to be of no value.

D.—SANSCRIT.

A Palm-leaf Manuscript, without label or number.

This very old, and greatly damaged, MS. on examination was found to be a fragment of a Sanscrit work in the *Grant'ha* character, composed by *Bava Bhupati*, one of the poets of *Bhoja-raja's* court. The leaves are eaten, in many places, by insects, others are lost: two sections, and part of a third, are found. The subject is of no historical consequence; and, as far as can be ascertained, contains merely poetical panegyric, as a sort of epithalamium.

Manuscript book, No. 50.—Countermark 1019.

Detached inscriptions at Conjeveram and *Sri Permatur*, in Sanscrit, *Grant'ha* character. No. 90. Dated in Sal. Sac. 1436. A long enumeration of the titles of *Crishna rayer* of the *Yada vamsa*, with the mention of some of his ancestors, deduced from the usual lunar-line. Much panegyric is bestowed on his munificence, to many other fanes; and, at the end, it is stated that he erected a magnificient cupola over the shrine of *Deva-raja*, or *Varada-raja*, at Conjeveram, in which there is much gold employed in the workmanship.

Remark. The cupola was taken down some years since, as I am informed, and has not been rebuilt; because of the great expense which would be required.

No. 100. Commemorates the munificence of *Laschmi-Cumara-acharya*, in causing a large and magnificient tank, or reservoir, to be excavated near the fane of *Hanumân*. Some panegyrical stanzas are added.

No. 101. Dated in Sal. Sac. 1591. Commemorates an endowment by *Sena Muthaliyar* for the purpose of certain chants, and ceremonies, performed at the first offering, or using, of water from the *tirt'ha* (or pool) in the washing, or bathing, of the image in the fane of *Varada-raja*.

No. 135. Dated in Sal. Sac. 1432. It commemorates the grant, in free tenure, of several large, and valuable, villages to the *Saiva* fane of *Yecambesvara*, by *Crishna rayer*.

No. 136. Dated in Sal. Sac. 1536. Commemorates donations made by *Tattácharyar*, which are specified; but of which the detail, in this place, seems not to be required.

CONCLUSION.

This Section of my general report here finishes. The necessity of any further remark seems to be obviated, by the observations offered, at each step of progress.

Madras, *June*, 30*th* 1838.

II.—*Notes on Ryotwar, or Permanent Annual Money Rents, in South India: and on the duty of Government in Periods of Famine.—By* John F. Thomas, *Esq. of the Madras Civil Service.*

To estimate the effects of a system of fixed annual money rents, in the present state of Southern India, it would appear necessary to keep the following points prominently in view. The peculiar circumstances of the agriculture of the country, the character, and present condition of the ryot, or landholder, and the state of society around him—and let us contrast the ryot in these respects, with the occupant of land in countries where annual money rents, as in Europe, have been for a long period the settled usage.

The ryot, or farmer, in the Peninsula of India is placed, we may first observe, from physical causes, in essentially different circumstances from the occupant cultivator in Europe. The intensity of unpropitious seasons in the temperate zone, especially in the case of drought, never being such as in tropical or Indian climates; whilst the variety of soil further secures the European farmer against *a total failure* of his crops. An unusually wet season in Europe causes the light soils to yield abundantly; and the dry year produces heavy crops on the deep land. It never occurs therefore, that the European holder, does not obtain some considerable return of produce from his land in each year; and though this return may frequently be below an average crop, yet the enhancement of price at these periods, consequent upon the great extent of the purchasing population,* at all times compensates him, for deficiency in the quantity of his produce, and his yearly money rent can invariably be paid therefore with little difficulty from the annual out-turn from his land.

But in Southern India, in seasons of drought, instead of any considerable return, there is frequently not a single field in the entire range

* Agricultural, or producing population in England 35 per C.—non agricultural or purchasing 65 per C.—Agricultural or producing population in India 90 per C.—non-agricultural or purchasing 10 per C.—See Babbage and other authors on the statistics of England.

of a ryot's farm, which is not either wholly barren, or very greatly deficient in produce. Often on the larger portion of his land, not an ear of grain is left, and the seed has not been returned to him: and even if some few showers should have fallen, and his well land has yielded a crop, he has still not a fifth or often a tenth of his ordinary crops to reap. No increase of price, it is plain therefore, can avail a ryot ought at these seasons; for he has no produce to bring to market, or but such a fraction beyond the wants of his family, that his entire crop will not give him any thing like the amount of his annual rental. The extreme pressure upon him consequently at these periods, arising out of the *physical* circumstances under which he carries on his occupation, places him in a wholly different position from the landholder in Europe: and in one, I believe, for which no providence, nor industry, can fully prepare him, if his full annual tax, or rent, be required from him, as prescribed by the present system, at a period, when he has lost nearly the whole of the year's outlay upon his land, and has not reaped grain enough either for seed, or to maintain his family through the year.

It is this peculiar feature of South Indian agriculture, resulting from physical causes, an almost entire failure periodically of nearly all return from the land, which constitutes a marked distinction between the circumstances of the Indian, and the European farmer or occupant of land, and which renders *fixed annual* money rents at their present rates, however advantageous in Europe, of doubtful policy in this country. When strictly acted upon for a series of years, it will, I believe, be found, that the heavy demand which this system makes upon the Indian landholder at seasons of extreme difficulty, and of peculiar loss, sweeping away at such times the whole of his little capital, or involving him inextricably in debt, is one of the chief causes of the present general impoverishment of the ryots. It is also to his knowledge of the certain recurrence of the periodical droughts, and their consequences; so fully appreciated by the ryot, but not yet, I am disposed to think, sufficiently considered by his European superior, that we must ascribe it, that he has been generally led to prefer a heavy; and vexatious tax in kind, of even 50 per cent of the *actual* annual produce, varying therefore with the season, to any permanent rent in money, at a lower rate. For he knows, that he is, under that tenure, protected in the season of drought, from a heavy Government demand,

which he has no produce to meet and which must entail upon him ruin.*

It is deserving of remark, that these seasons of very severe drought where the seed is not returned, and which are known by a peculiar term, recur on an average in the southern provinces of the Madras presidency once in seven years. From acconnts before me from Coimbatore, and Trichinopoly, five years of this kind are named within the last 33 years.

But it is not only in the want of adaptation to the peculiar physical circumstances of the agriculture of the country, that fixed and invariable annual money rents are open to objection ; they appear also unsuited to the present circumstances of the great body of ryots. The mass of the land is held in very small parcels, by proprietors of petty tenements under 30 or 40 rupees. Proprietors of this class can possess little or no capital, and very limited credit, and that only upon ruinous, and usurious terms. How is it possible then, that they should be able to meet all the contingencies, both of price and season, affecting so large a proportion, as the Government share of 33 or 45 per cent of the average annual produce of their land.

* "Their objections (the ryots of Trichinopoly) are stated to have been, that if the land be once assessed at a specific sum in money per cawney, a fall in the price of grain, or an unfavourable crop, will make the payment of the Government dues extremely difficult. Whereas, at present, we suit our consumption to our actual produce ; and in the event of a deficient produce, although we cannot consume so much as we should in a favourable year, we have still sufficient to maintain our families unburthened with any payment, unfettered by any penalties. *We preserve our lands*, and if we do not grow rich, at least *we are not utterly ruined.*

"They alone must be the judges, whether it is more beneficial for them to pay a proportion of the produce in kind, or, a fixed sum an equivalent in money."—*Madras, Rev. Sel. vol.* III. p. 519.

"In many cases, too, the objections (of the ryot) to fixed money-payments appear to be well founded. The precariousness of the produce and the poverty of the cultivator, rendering it necessary that the rent should either be paid in a proportion of the crop, or that the ryot should adopt the less advantageous mode, of trusting to an undefined understanding that a part of the stipulated rent will eventually be relinquished".—*Madras, Rev. Sel. vol.* III. p. 158.

"During my late tour through this territory (Dehli, &c.), the dissatisfaction of the zemindars at nukdee or money-settlements was almost universal, the inconvenience to which they have been, in consequence, subjected from bad seasons, being of a species unknown to them formerly".—*Rev. Sel. vol.* III. p. 415.

"The disadvantage immediately resulting from this system, and which constituted the chief difficulty in effecting village rents, was the balance left out-standing at the end of the year, the account of the Circar grain remaining unsold ; and the difficulty of converting it into money, so as to realize the revenue within the year. The inhabitants aware of this difficulty, were averse to the responsibility of a money rent, and the actual experience of many years justified their apprehension".—*Rev. Sel. vol.* I. p. 562.

The ryots of Southern India are also, like all individuals of limited means and education, improvident. They are in eight cases out of ten in debt.* It must surely be idle to look to them, for the forethought which shall store up every small gain of a favourable year, to meet an adverse season. This providence can and does exist, only in educated and highly civilized communities, and is the very reverse of the national characteristic of the Indian agriculturists; not one of whom from high to low, scruples to involve himself irretrievably in debt for marriage or funeral ceremonies. A system therefore, which throws upon the Indian cultivator, the whole onus of providing for every emergency, and requires from him the forecast, to meet all the variations in the market, as well as those of the seasons, is manifestly ill adapted to his present character, and condition, and little calculated to enable him to realize property in the soil.

The system is likewise, I conceive, unsuited to the existing state of society in Southern India, of which the preponderance of the agricultural class is a peculiar feature. This feature of Indian society renders the demand of a permanent *annual* money rent, not only highly disadvantageous to the ryot, but, it may even be said, unjust. For the large excess of the agricultural population over all the other classes, of not less than eight to one, necessarily brings an immense surplus of grain into the market in favourable seasons. Prices in consequence fall exceedingly low, there being no foreign vent for grain in Southern India; and the ryot, in lieu of gaining largely, not infrequently receives less money for the whole of his crop brought to market, in productive years, than in an average season, or in one a little below it. He therefore finds more difficulty in paying his money tax at such periods; and he may be now occasionally even a loser, and his gains must at all times be very inconsiderable in abundant and favourable seasons. Whence then in the present state of society is his profit to come from, to meet the loss and deficiences of unproductive years, and of seasons of excessive drought? The rule now in force, of an invariable annual demand in money on an average crop, and at average prices, makes no provision for this peculiar condition of society. It is assumed, in the teeth, I think, of facts, that the profits of favourable seasons, always are, and will be adequate to meet the demand of unfavourable years; and the whole burden of failure in the season, or fall of price,

* "The difficulty lies in the character of the ryots whose improvidence renders them to so great a degree incapable of realizing property when the means are put in their power."—*Court of Directors, Rev. Sel.*

"The debts and embarrassments in which the whole of the agricultural population is plunged." Mr. Elphinstone.—*Jud. Sel.* iv. p. 14. 3.

is, under the existing system thrown on the poor occupant of a 30 rupee tenement to his utter ruin. There is also, a further disadvantage to the ryot in money rents, which does not exist under the native practice of a division of crop. Under that system, bad as it is in all other respects, there is this advantage, that the Government dues are only taken, when the ryot is best able to pay them, at the precise moment at which he has gathered in his produce, when it is easy for him to assign to Government its portion, and he has then no subsequent demand to meet. But under ryotwar money rents, the entire crop is left upon the ryot's hands, and all the risk of subsequent fluctuations, falls upon him. The rents in money are also usually exacted with such unsparing and rigorous punctuality, that the great body of the ryots from their want of capital, are practically compelled, in order to pay the Government dues, to bring the whole of their grain to market at a loss within the year. Whereas, had the rents been taken in kind, the Government would have stored a large portion of the year's crop for future consumption, and much would have been kept out of the markets: the share left to the ryots would have been brought consequently to sale gradually, and against it is probable less competition, and to a better market, even allowing for the diminished demand which must result, when the revenues being received in kind, Government payments are also made in grain.

In the foregoing remarks on the circumstances of the south Indian ryot, arising out of the peculiar nature of the agriculture of the country—his own habits and present condition, and the state of society; we have only considered the effect of permanent annual money rents in cases, in which the landholder (the ryot) or the party answerable for the Government tax, and the actual cultivator of the soil, is one and the same. Let us now view the subject where the tenure of land is different, as in provinces like Tanjore, where the land is in the hands of proprietors who do not themselves till it, but enjoy a landlord's rent. Where therefore, property in the soil has not to be created but actually exists. It will then I believe be seen, that the rule, which prescribes an *invariable* annual demand in money, is not merely unsuited to the circumstances of the landholder, but if not modified, absolutely destructive of his well-being and to the existence of all saleable property in the soil.

The gross produce of the wet land in Tanjore irrigated by Government works, is divided upon an average nearly as follows; 50 per cent. the Government tax or assessment, 25 per cent. charges of cultivation or an allowance to the actual cultivator (the occupant *cudi*), 12 per

cent. village cesses ; total 87 per cent. leaving about 13 per cent. as the merasidar's, or proprietor's rent. From this, the merasidar supports his family, keeps the minor water-courses in repair, provides advances of seed and stock for the occupant cultivator, and under the new ryotwar system of fixed annual money rents, he takes upon himself the risk of the fluctuations of season, and of price on the Government share. The Government relinquishing to him upon this ground 5, or 8 per cent. of its share, and he is expected for this consideration, to bind himself for an *invariable* annual payment to Government, of 45 or 42 per cent. of an *average* crop, at a fixed price.

The cultivators, or occupant *paracudis*, unable to take any part of this responsibility, continue the ancient usage of a division of the crop. They at all times receive their share of the produce in kind, and at all seasons also, the merasidar has an outlay of 2 or 3 per cent. from his own share, on the water-courses, and in advances of seed, besides his payments in village cesses. His annual liabilities are therefore not less than from 80 to 85 per cent. of an average crop, of which, under ryotwar, 40 to 45 per cent., is further commuted into a certain and invariable annual money payment. If crops are deficient in any season 15 or 20 per cent., he receives little, or nothing. The whole produce is barely sufficient to cover the Government, the *paracudis*, and the village demand. If the returns should be still less, i. e., if there should be even so slight a variation, as 10 per cent. of decrease in price below the standard, combined with 15 per cent. in produce, he is most seriously affected. These minor fluctuations he can stand for a short time, for his land is saleable, and his future returns, as they depend upon the south-west monsoon, sure he can therefore command credit at a moderate rate. But if prices, and produce should in one or two seasons both fall 20 or 25 per cent., a total of 40 or 50 per cent., his final bankruptcy is almost certain, and as seasons of this kind always occur in the course of every eight or ten years, the eventual destruction of property in the soil, under this system at the present rates of assessment, appears inevitable.

The merasidars of Tanjore have seen this, they have in consequence strongly opposed the ryotwar invariable money rents, and have proposed these terms. That when produce is deficient 20 per cent., or upwards, they shall revert in effect to the old usage of an equal division with the Government of the actual crop.

The justice, not to say necessity of this provision under merasi, a tenure, which allows a proprietor's rent, as well as a Government tax, will I should think be admitted, if we consider—that the gross re-

ceipts of the merasidars, cannot in the best years exceed 25 or 30 per cent. of the produce, that independently of the share apportioned to the *paracudies*, the merasidar pays from his own share of the produce, a further part of the charges of cultivation, in finding the seed, and repairing the minor water channels, and that his family is to be maintained, and clothed from the produce left to him after all outgoings have been provided for. His largest net surplus profits therefore can scarcely, at any time exceed 8 or 10 per cent. per annum be he ever so prudent. And it must be impossible for him, with an annual surplus of this extent, to undertake the liability for a permanent 42 or 45 per cent.; in a country, where crops often fluctuate, 30 per cent., and where price in abundant years sinks 50 or 60 per cent. and even more.

The following memorandum of the produce, and prices, in one of the richest of the talooks in Tanjore (Sheally) in the four years immediately preceding the introduction of the ryotwar money rents, affords a striking instance of the fluctuations to which both prices and produce are subject in this country, even where the lands are watered by the south-west monsoon.

Years.	Produce of the Talook.	Prices.
Fusly 1233 .... A. D. 1823-4........	5,37,000 cullums....	1 R. per cullum.
Fusly 1234.......... A. D. 1824-5........	7,14,000 do.... ..	1 R. 2 Annas do.
Fusly 1235.......... A. D. 1825-6........	5,91,000 do.... ..	—— 8 Annas do.
Fusly 1236.......... A. D. 1826-7........	8,24,000 do....	—— 7½ Annas do.

We see here, in the short term of four years, produce fluctuating 30 to 40 per cent., or from 5 to 8 lakhs, and prices 130 per cent., with the remarkable feature, that in the third year fusly 1235, produce *decreased* nearly 20 per cent. on the previous year, not the best of the four, and prices fell at the same time more than 120 per cent., making a total fall on the preceding year of 140 per cent. These are the fluctuations in the short period of four years, and there is no reason to doubt that like variations in produce, though it is probable, not to the same

extent in price are common. Where such great fluctuations exist, it must, I think, be evident, that a proviso, for casting upon Government in seasons of great decrease of price, or produce, its full share, if not the whole of the deficiency, is absolutely necessary, or the proprietor will be in a few years ruined, by the large and varying demands which he is unable to meet from the annual produce, and all trace of property in the land must eventually be swept away.

So little attention would seem to have been hitherto paid to this effect of an invariable annual money demand, especially *under the different species of tenure*, that this very proviso in the permanent field assessment of the Tanjore province, which is essential to the existence of merasi tenure, in other words, of property in the soil, has been pronounced by high authority (Proceedings of Government 1833) wholly indefensible, as at variance with Colonel Munro's ryotwar of the Ceded Districts. That it is a departure from that system is palpable. But the question is, is it not absolutely necessary to the existence of proprietary right, not only in Tanjore, but elsewhere; and is it not a further evidence that the ryotwar system of permanent money rents is ill adapted to the circumstances of the agriculture, to the state of the landholder, and to the condition of society in this country.

In support of this opinion we may adduce the fact, that although the ryotwar system of a fixed *annual* money demand for each field occupied by the ryot, without reference to the annual out-turn from it, has been professedly in force in this Presidency for many years, it has rarely, if ever, been carried out. In the Ceded Districts, and other ryotwar provinces, a departure in practice from one of its fundamental rules has been admitted for years, by the grant of remissions; but more especially by the practice of not making the annual settlement (*dittam*) for the ryots holding, till towards the close of the year, and then determining his rent, not by the actual extent of his occupancy, and his cultivation during the year, but by his productive fields.—Thus throwing the risk of season on the Government, and annually regulating in fact the demand of revenue in a province in each year, by the character of the season, by the crop reaped, and the number and extent of the productive fields of the ryot, and not, as ryotwar prescribes, by his occupancy.

The 7th rule of ryotwar stands thus (see plan of ryotwar Colonel Munro's letter 15th August 1807, appendix to 5th report p. 944). "No "remission shall be made on ordinary occasions of bad crops, or other "accidents should failure occur which cannot be made good from the "property, or land of the defaulter, the village shall be liable to 10 per "cent." And the practical application of this rule is explained by

Colonel Munro to his sub-collectors as follows—" Whatever may have " been the crop should it have been even less than the seed, the ryots " should always be made to pay the full rent, if they can, because good " and bad seasons being supposed to be equal in the long run, the loss " is merely temporary and the making of it good, is only applying to " the deficiency of a year of scarcity the funds which have arisen from " one of abundance." (Letter of Principal Collector—Ceded Districts to his assistants on remissions, appendix to 5th report page 769, para 5).

If this rule be not enforced, and the full rent for every field occupied during the year be not duly collected, it is manifest, that each field is *permanently* taxed only in name, and that the amount of the ryots' payment or the annual tax on the land, is regulated by the crops or returns to the ryot, and by his means at the time of demand. It is the same thing of course to the ryot whether the Government practically reduces his rental by striking off so much of the fixed tax on each field he has held, or by striking from the account, a portion of the field themselves, which he has occupied at a fixed assessment, the only point he can be anxious about, is that the demand upon him, should be limited annually to an amount which his annual produce will enable him to meet. The great, if not the only end then now answered by ryotwar, is to determine once for all a maximum payable by the ryot for the land he may have been induced to occupy, which shall save the necessity of an annual contract with him; and leave the revenue officer, the sole duty of extracting from him at the close of each year, the utmost he can pay even though the seed has not been returned.

That a demand and collection regulated by the out-turn of the year, has been, and I may add, must be the system in force, under a fixed money assessment on an average produce, might also, I think be demonstrated by an appeal to experience, as well as by the consideration of the peculiar circumstances already adverted to in the nature of the agriculture, and in the condition of the ryot. I would refer to the practice in ryotwar districts of granting remissions under various forms, and this, not as an extraordinary boon, but as a part of the system in practice whatever may be the theory, as one proof, that permanent ryotwar rents have never yet been realized. Again, the amount of balances of rents in ryotwar districts struck off as dead loss in the account general books. These enormous sums, further proving the absolute failure of the attempt to collect a fixed *invariable* annual rent in money from each field occupied. Finally, let the total revenue, or the full tax on all the land held for five years by the ryots at the beginning of each fusly, in ryotwar districts, and the amount

actually realized in the five years be calculated and compared, and it will be evident, I believe, that the system has been in districts assessed at the full rate of 33 and 45 per cent., not so much to consider the amount, for which the ryot may have engaged by his occupancy, as the rent to be collected from him, but, what he could actually afford to pay, with reference to the returns from his land in each year.

If the permanent money tax should, as in Coimbatore, have been fixed at, not more than 25 per cent. of the gross produce, with this peculiarly low assessment in its favour, the people will bear up under it for a long period, especially, when it has been also accompanied by remissions, and every species of indulgence to the ryot. So also, if one province, like Cuddapah has a comparatively rich soil, and an extraordinary proportion of rent-free lands, or like Bellary, has been especially favoured by a general, and permanent deduction of 25 per cent. of the Government dues, whilst other provinces have not received a fraction; these provinces will of course comparatively flourish. But is it the ryotwar money rents, which produce this result? Or is it not solely in such districts the light assessment—and that, happily for the people and the permanent interests of Government, made lighter, by a departure from ryotwar, both in the remissions granted; and by the substitution for a settlement at the *commencement* of the year on the land held, and a fixed demand accordingly, a settlement towards its *close*, regulated by the season, and by the actual produce of the year.

The failure hitherto to do this fully, and the impolitic attempt to collect, as prescribed by theory, the full assessment annually, even in years when the seed has not been returned, combined with the forced cultivation of the soil, have been, I conceive the chief causes of the present depressed condition of the landholders. The demand which has been made upon them for years past in seasons of difficulty, has even, I fear, sapped the sources of future improvement and prosperity, by draining from them, their little capital, and preventing those accumulations, which can alone enable the ryot to profit by the peace, and security afforded by British rule. It is also to this severe pressure of late upon his resources in periods of difficulty, to which we must look, as the great proximate cause of the present decrease of the land revenue.

The evil of a fixed annual money rent, when persevered in for years, is not confined to district assessed at the full ryotwar rates, for when it does not, as in provinces lightly assessed, bankrupt the ryot, it manifests

itself in the diminution of substantial and wealthy ryots. The following table drawn from the accounts of thirty three villages in the Kangyam talook in the Coimbatore province will shew the effect of the system when combined with the practice of forced cultivation :—

Years.	Total numb of Ryots.	Ryots paying from 50 to 500 Rupees.	Ryots paying from 30 to 50 Rupees.	Ryots paying from 1 to 35 Rupees.
In 1801	1778	78 or 1 in 23	709 or nearly one half	971
In 1816	3449	34 or 1 in 100	1231 or about one third	2234
In 1831	5031	28 or 1 in 180	1396 or about one fourth	3607

The whole of the increase it is of importance to notice in the years from 1816 to 1831 is in the smaller holdings, and chiefly in the pauper tenements from 1 to 35 rupees—whilst the wealthy ryots, in lieu of increasing under our rule, have diminished in number from 78 to 28. A similar result after making the necessary allowance for the practice of wealthy ryots subdividing their lands nominally, by entering them in the names of their dependents, is exhibited in a statement from the Caroor talook. And personal enquiry, tended to establish the fact, that formerly a larger proportion of the occupants of the soil, were substantial ryots ; whilst it is apparent that at present the great mass or more than three-fifths are in this favoured ryotwar district little better than pauper labourers, occupying for the most part tenements at a rent of trifling amount, which they pay with difficulty in seasons at all unfavourable.

Ryotwar authorities, are in the habit of ascribing this increase of small, or, pauper proprietors, to the usages of the people alone, especially to their law of inheritance. They do not appear sufficiently to advert to the fact, that the same law and usages have existed for ages, and that this sudden, and rapid augmentation of small proprietors within the last twenty years, cannot well therefore be the result of a long prevalent usage, but must have its origin in some more immediate cause. The augmentation is no doubt, in part, the effect of the greater security of property and person under British dominion ; but there is little reason also to doubt, that it must chiefly be ascribed to the revenue system in force.

The extreme subdivision of property, and the rise of this large class of pauper landholders, have also been advocated as beneficial to the

country by some ryotwar authorities who have kept out of sight the momentous consideration, that the return from land held by this class, is full one third less, than if cultivated by a proprietor of substance, who could afford to dress it properly; and that the permanent effects of a system which brings the mass of the land into the hands of the poorer classes, is, to place the country under a sentence of comparative sterility, covered like Ireland with pauper occupants, without capital to meet any reverse, or surplus to undertake any improvement; and unable to command those comforts and conveniences of life, which would gradually raise them in the scale of society, and advance the country in civilization and wealth.

Before closing these remarks, I would notice briefly two other evils inherent in fixed money rents. All fields permanently classed and assessed as wet or garden land (*Nunjah* or *Bhagayet*) must continue always such, in order to give the higher permanent tax. The conversion therefore of wet or garden into dry grain land according to the varying demand of the market, is prohibited by the system itself. And though the demand for garden or wet produce in a district, may fall off 50 per cent. or more, and prices may sink, to an extent to make such produce an unprofitable crop at the wet, or garden rate of tax, compared with dry grain, yet the ryot has no option, he must still sow this land with rice, &c., for that alone will yield in money the higher rate of assessment.

Again no adequate provision is made, except in the putcut ryotwar of Coimbatore, for fallows, and for the exhaustion of the soil, the certain consequence of the continual cropping rendered necessary to enable the ryot to meet the invariable annual Government demand. Of the evil effects of this omission, the following instance was brought to my notice. The *Bhagayet* of a ryot, then a flourishing and productive property, had been classed and permanently assessed in 1802. But in the long period intervening, the soil had become exhausted, and did not return any thing like an average crop. Still the proprietor was called upon to pay for it, the same full *Bhagayet* tax, as when first assessed. At the date it was examined (1832), the land was so exhausted by continual heavy cropping, as scarcely to repay the charges of cultivation, and for some years previously it had of course been deteriorating, whilst throughout the whole period of this deterioration from natural causes, the full rent had been demanded, and paid. The means of the holder were necessarily therefore annually impaired, till he became unable to bear the tax; and nothing but ample remissions, not

for one or two years; but for a term could save him from ruin. Yet revenue authorities strictly following out the principles of ryotwar, and not sufficiently bearing in mind the peculiar physical circumstances of the agriculture of the country, and the present condition of the people, denounce all remissions, as incompatible with sound revenue management. Whilst it would appear almost self-evident, that so long as produce, and prices annually fluctuate very largely, and droughts are constantly recurring; so long an unvarying annual money tax on each field, cannot be imposed upon a small proprietor without his *utter ruin.* And further, that so long as the bulk of the landholders remain, what they now are, proprietors of petty tenements, and without capital, the principle of a fixed *annual* money rent, which leads inevitably to an extreme pressure on the ryot in adverse seasons, is not a sound and practically wise system.

Assuming such to be the case; and both experience, and theory would seem to confirm it, I would suggest for consideration some modifications of the existing revenue system, which would I believe greatly relieve the agriculture of the country from its present depression—and gradually convert the ryots into a body of wealthy landholders—without trenching largely on the Government revenue. To avoid misapprehension, I would here remark, that it is not ryotwar, *as a mode of collection*, of which it is the chief feature, that there shall be no middle man, between the Government and the occupant of the soil, of which I should propose a modification. For under the present circumstances of South India, and in the general ignorance of all classes of the people, I do not think there is any class, whether zemindar, mootadar, or the heads of the village community, to which the well-being of the ryot can be so safely entrusted, as to the European officers of Government; and I should regret to see this important feature of the Madras revenue administration touched. But looking to ryotwar as a mode of *assessment* on the land, containing as its leading principle, the imposition of an unalterable money-rent on each field, payable annually, under all circumstances of season and of price,—it is to this, I object, and would raise the question whether it is not highly injurious to the ryot in the long run, whatever may be its temporary advantages.

In considering the modifications required to adapt the revenue system fully to the country, I take it for granted, that it is not in the power of the Madras Government to relinquish any large portion of the revenue at present raised directly from the land; and consequently that the Government is not prepared for that great practical measure of relief,

which might render every other measure unnecessary, of reducing the rate of tax on all land occupied, and not irrigated by Government works, to the ordinary poonjah or dry grain rate, and thus yielding to the ryot for ever the entire benefit of all improvements on his land. The plan proposed, proceeds therefore upon the supposition of giving up as little as practicable of the present amount of land revenue; and of leaving waste, and other sources of future income from the land open.

I would suggest first, as better suited to the circumstances of the country a permanent assessment on each field in grain, commutable into *variable* money payments, in lieu of the permanent tax in money now assessed. The commutation to be made periodically with ample allowance for unfavourable years.

The basis of the system, would therefore be a fixed corn or produce rent, as a maximum rent, commutable into a money payment, regulated by, and varying periodically with the actual state of prices.

An assessment varying from time to time with prices, in lieu of the permanent money tax of ryotwar, appears to be required; not only because prices are found by experience to be subject to very great alternations, but because money itself alters in value, and the land-tax of a fixed amount of money, which may at one time be light and equitable, may become by changes in the value of the currency oppressive, and intolerable. But it is chiefly necessary, because the amount of the tax on the land is so large, and the capital of the ryot so limited, that a very trifling alteration in price, is of vast moment to him; and because, the excess in this country both of agricultural population and capital, over non-agricultural (which from the influence of caste must continue) is such, as of itself to induce a constant tendency to an overstocked grain-market, and consequently to depreciation of price. Any *permanent* money tax, founded on an average of prices drawn from the state of the markets during previous years, will therefore, in the long run, prove injurious to the landholders. And it will be found, I believe, essential to the prosperity of the ryot of South India, when his rent is received in specie, that the money tax on each field unless extraordinarily low, should not be permanently fixed, but that a review of the state of prices should take place at short intervals, and the Government demand be adjusted accordingly.

A fixed moderate average corn or produce assessment, which shall be the maximum of the Government demand, would also hold out to the proprietor, or occupant, the strongest inducement to improve his land, as it will effectually secure to him, the *whole* increase arising from better cultivation, or from capital sunk in improvements. This can never

be attained by *a fixed money* rent on each field, at *the present rates*, for every considerable fall in price, an event of frequent occurrence, must disturb the calculations of the ryot, and destroy all certainty of profit from such outlays under that system. But, if he has to take into his consideration, only the fluctuations of produce, he can estimate his prospect of success with more accuracy, and he is secured against one source of failure. This, it is obvious, must lead to a more frequent, and successful investment of capital in improvements, so important both to the individual and general welfare.

These two points—a fixed maximum assessment of grain or produce on each field, and a fair commutation price varying periodically with the market, being established, I would further engage on the part of Government, that in years of drought, when the produce might fall short 20 or 25 per cent., or upwards of the average, taken as the basis of the assessment, that the deficiency beyond that, should be borne in part if not wholly by Government. For instance, if the ordinary *average* produce of the cawney be rated at 100 measures, and the rent be fixed accordingly, and the actual crop in any year, shall be reported by the collector to have fallen to 75 measures, or less, a general, and well defined remission of tax, according to the extent of the decrease in produce, should be authorized.

And further, in years of excessive drought and total failure, when the land has made no return, not even the seed, that there should be a postponement of demand, or an entire relinquishment of the Government dues on such land. This I am satisfied will prove the only wise course at such periods. For it is certain, that the suffering inhabitants will find sufficient employment for any surplus funds which they may possess, in meeting the high prices of famine. And it will be the better policy, as well as a moral duty to leave to them the full extent of their resources, to bear up against the visitation, and to provide some small surplus, to commence anew, when the pressure shall be past.

As a compensation to Government, and to enable its treasury to meet the defalcations of calamitous seasons, I would adopt the rule, that in all years of high price, combined with an average produce, or one above it, when the profits of the cultivator must be certain and large, that after a limit say 10 or 15 per cent. advance in price, the Government should participate, and receive a proportionate increase of revenue, an addition of 5, 10 or more per cent., according to the extent of the rise in price. This would of course prevent, as all taxation on the land must, the rapid augmentation of the national wealth. It must make its progress more slow; but it would not be found greatly to retard improvement.

It should be considered as an extra demand, to be regulated at the lowest scale compatible with the exigencies of the state, and it would be found when tried by the test of general principles, the best *present* available source of revenue. For the extra tax would be imposed, only, when the surplus wealth of the people is largest, and not like the permanent tax of ryotwar, often when their means are lowest; and one of its chief effects would probably be, to divert into the coffers of the state a portion of the sums now wasted on marriage festivals, and in similar occasions of large personal expenditure; for it is in that mode, that the extra gains of profitable years in lieu of being husbanded, are at present expended by the ryot.

The system here proposed is in force in its leading features, in several of the best managed properties in Scotland and England, and a reference to the evidence annexed to the last Report of the Committee on Agriculture of the House of Commons (1836) will shew its beneficial effects. Its first principles, a corn rent with a fluctuating commutation price within a defined limit, are contained also in the *Co'o:ngoo* system of Tanjore, introduced nearly 15 years' back, which has been, and still is in operation throughout a large portion of that province. It could not meet therefore with any serious difficulties in practice, indeed the ryotwar, as it is termed, of Tanjore, recently introduced, also contains some of its essential elements; and it is in favour of the plan, that the merasidars of that province, who are without doubt competent judges of what is necessary for their permanent interest, have rejected a fixed annual money rent, and required a modification of the ryotwar tax of the nature here suggested, in order to meet the necessities of unfavourable years.

The chief objection which would attach to the plan, is the obvious evil of the occasional changes of settlement required, in order to adjust the commutation price. To obviate this objection, we might take as our guide, an average of only the low, or medium prices of the previous seven or ten years, and fix the standard price at this rate. Owing to the circumstances repeatedly adverted to, particularly the large excess of the agricultural population over all other classes, which make low prices the general rule, and high price the exception in this country, the Government would lose but little, in excluding from the commutation average, years of high price, and two most important advantages would be gained.

The ryot, or merasidar would be secured against over demand; and it would not be necessary to interfere with him frequently, for it would probably be found, that the rent fixed on a commutation taken at this

low average, might safely go on for seven or ten years together, and new engagements would not be called for oftener under this system, than once in ten years.

The advantages which the proposed plan would possess, over the present system, are.—First, that it unites the benefits which result to Government from an assessment in money, with those which the ryot enjoys from an assessment in kind. That it does not like the ryotwar require from a people wholly unprepared for it, the duty of a forethought foreign to their habits, nor throw upon them the burthen, to which they are unequal, of all fluctuations of prices, as well as of periodical drought, and of alterations in the value of money.

Secondly, it provides more effectually for the profitable outlay of capital in the improvement of the land, by establishing a better defined and more certain Government demand, a maximum rent not liable to fluctuation.

Thirdly, it secures the landholder, equally with the immemorial division of the crop, from the ruin, and total bankruptcy, which seasons of excessive drought must bring with them, when he is, as at present, required to yield at such times to Government, the 33 or 45 per cent. of a produce, of which he has never reaped ten, nor possibly one per cent.

The Government revenues would also suffer, but little in the course of years, as the treasury would be filled by the extra levy, in years of average crops and high prices, and by the more regular payments in ordinary years, the consequence of a more equable demand. The cases of failure also would necessarily be few, when the Government itself shall provide against the larger fluctuations, and when the system in force, shall not call for the exercise of a providence which will not be found amongst the ryots for generations to come; and which were it now the national characteristic, would not avail the ryot under the existing high rate of tax on the land, joined with the extreme subdivision of property growing out of present usages. Both these causes precluding the accumulation of capital in the hands of the landholders, which might enable them to meet the heavy Government demand in unfavourable seasons.

It may be observed finally, that, if this substitution of a commutable corn or produce rent, for a fixed money rent, has been found of late years, from the great fluctuations in price alone, expedient even in England, where the farmers and holders of land compared with the South Indian ryots, are persons of large capital and extensive credit; and where also, produce and prices never fluctuate to such wide extremes. It would appear to be still more required in South India,

and it can scarcely be doubted, that it would be found better adapted to the wants and character of the agriculturist, and to the peculiar circumstances of society around him, than a system, like ryotwar, which demands the same annual money tax invariably, admitting in theory of no remissions, and having in practice none adequate to the heavy losses of unfavourable years either of produce or price.

On a Redemption of the Land Tax.—In concluding these Notes I would throw out for consideration, as a measure practicable, under the existing, or any system of revenue administration—the expediency of conceding to the landholder the privilege of redeeming the land tax for lives, or for a term of years.

A provision of this nature, would, it is probable give an important impulse to agriculture ; and without it, it is I fear hopeless to expect any decided improvement at an early date. For if the land is to bear an annual heavy assessment, it follows, almost as a necessary consequence, that every proprietor will continue from year to year, the old routine of cultivation, in order to ensure the amount of his tax. But were his land wholly free from tax, for a term, he might, and would be disposed to speculate in raising new and more valuable products, the returns from which must in the first instance be uncertain. And when we consider that it is not often, in consequence of the great subdivision of property by law, that agricultural capital accumulates in one hand, in this country, it is of the more importance, to open such a field as the redemption of the land-tax would do, to induce its employment on the land.

It is almost certain, that the late efforts of Government to engage the ryot in the cultivation of tobacco, senna, sugar, &c., must fail of any practical utility, unless a measure of this character is at the same time adopted; which shall enable him to undertake the cultivation of such products without the risk, which now attends the attempt, of not having wherewith to meet his annual tax ; and with no adequate security also, that if successful, a heavier assessment will not be the early if not the immediate consequence.

The redemption of his land tax would, at the same time free the ryots or merasidars, from the constant interference of the revenue officer, and would lead to improvements from which they are now deterred by the knowledge, that the public officer can, and will interpose whenever any change is made. It is also by this means that they will be enabled gradually to rise above the tutelage and influence of the tahsildar, from whose interference they now often suffer. Whilst under a re-

demption of the tax, the ryots would partially escape the evil of the successive revenue experiments which must continue to be made, till the land is in the hands of proprietors, equal in intelligence with their rulers.

There can be little doubt also, that the measure would give much greater stability to the revenues of the country. For the redemption, in other terms a payment in advance on an equitable adjustment of the Government demand, excludes the possibility of remission; and the possession by the ryot of a portion of his land in all seasons rent-free (the tax being already paid) must give facilities to the punctual realization of the annual revenue.

It would at the same time, it is probable, be found to operate beneficially on native habits. As the prospect of freeing his land for a term from its burdens, would hold out a great inducement to the ryot to expend his accumulated savings on his land and he would inevitably be tempted to turn off a part of his present wasteful expenditure on marriage occasions, &c. into this more profitable channel.

I am not aware that any evil could result from according this privilege to the land-owners, if it were confined, as it should be in the first instance to a term of 15 or 20 years, renewable at the option of the owner, for 10 or 15 more, on the payment of a limited fine or premium. It would then, I think, work well for the country without diminishing the Government revenue. It has been adopted on a much more extensive scale than here proposed in Ceylon, and if applicable to the state of society, and the tenures of land there, it can scarcely be found inapplicable to the neighbouring provinces on the contiment, in a great measure similarly circumstanced.

On the Interference of Government in periods of Famine.

The entire failure periodically of all return from the land, and the improvidence and poverty of the great mass of the ryots, which have been adverted to as incidents in the agriculture, and in the state of society, peculiarly affecting the question of permanent money rents in this country, apply, I conceive, equally to another question, scarcely less important—the duty, and policy of the Government in seasons of severe dearth or famine.

The doctrine now promulgated on this subject, is professedly based upon the principles of political economy, and drawn from Adam Smith's

work (Book iv. ch. 5. Digression on the Corn Trade and Corn Laws), but rather I must think from the letter, than from the spirit of that enlightened work. The circular orders of Government* which embody Dr. Smith's arguments, overlook apparently the important consideration, that his views are mainly, if not wholly grounded upon the circumstances of agriculture, and society in Europe alone, and even in Great Britain; and that in the very few remarks he makes in reference to famine in India, his premises are incorrect, and his conclusions necessarily therefore of little weight.

Dr. Smith first states as an historical fact, that, in Europe, owing to the variety of soil, and the nature of the climate, "*the grain lost in* "*one part of the country is in some measure compensated by what is* "*gained in another, and that a famine has never arisen from the fault* "*of the season, nor from any other cause than the violence of the* "*Government attempting by improper means to remedy the inconvenience* "*of dearth.*" In this statement, so far as Europe is concerned, we may fully concur. But when he goes on to assume, that "even in rice "countries, the drought is perhaps never so universal as necessarily to "occasion (of itself) a famine," and *that famine has always been induced in India, by the acts of the Government* we must, with our more enlarged experience of the nature of tropical droughts, withhold our assent. For we well know from bitter experience, that although the Government of India for years past, has most rigidly abstained in seasons of scarcity from all interference,—the most intense and deso-

* *Circular Orders, 30th January* 1833. "The Right Honorable the Governor in Council requests, that you will take every suitable opportunity of explaining to the Judicial Officers, with the desire that they will inculcate the same upon the native servants, that in a time of scarcity, high prices must obviously constitute the best security against the calamities of famine. When there is a deficiency of the necessaries of life in any country, the only method of counteracting the evils resulting from it, is to diminish, as much as possible, their consumption. This is effected by high prices better than any other measure, for as every poor man is compelled to contract his wants to the smallest quantity of food that can support him, it is plain that a larger number of families are thus enabled to subsist upon a diminished supply whereas the interference of Government in such emergencies either by fixing a maximum of price, *or by throwing a quantity of grain into places which would not receive it in ordinary course of mercantile speculation,* disturbs the natural current, by which, where trade is free, the demand of any commodity is sure to meet, as far as circumstances will allow, with a corresponding supply, and has a tendency (which it is to be feared has too often been realized amongst the native states) to convert a season of scarcity into one of absolute famine.

The Right Honorable the Governor in Council considers it highly desirable that the natives in the provinces should be made acquainted with the sentiments of Government on this important subject, and be apprized of the calamitous results which would inevitably follow any other line of policy."

lating famines have nevertheless prevailed. And it is open to every day's observation, that the drought in whole provinces, contrary to Dr. Smith's assertion, is ordinarily universal: the failure which affects one field, affecting all. And further, that in South India, and we might add in tropical countries generally—there is not that variety of soil or climate, which can compensate the failure of the periodical rains.

If we cannot premise then of India, as we can of Europe, that famine "never arises from the fault of the season alone," Dr. Smith's principles, and his whole reasoning fail of application to this country, and the orders of Government based upon them, rest consequently on no solid foundation.

The Government orders appear also erroneous, in applying without limitation to the grain trade of South India, the great general principle established by Smith, that, "where trade is free the demand for any "commodity, is sure to meet as far as circumstances will allow, with a "corresponding supply." In applying this principle to trade in the food of a country, we shall err, if we omit to take into our consideration the striking peculiarity of the corn trade, *that it admits of no delay in its supplies.* The supplies of grain must arrive at the precise moment they are required, or they are useless, the evil has been done, the consumers themselves have been cut off. The truth of Dr. Smith's general principle no one will be disposed to question, as respects trade in general, and even the grain trade in seasons of scarcity in Europe, for the reason he repeatedly assigns, that the energy and enterprize of the British or European merchant in pursuance of his own interest, will always supply the market *more readily*, as well as more cheaply than Government agency: and it follows as a necessary consequence, that if the Government interfere in the corn trade in Europe in a period of dearth, and the private trader withdraw, the requisite supplies will be provided more *tardily*, and at a greater cost, and a dearth or a temporary famine will ensue.

We know well that in periods of scarcity in England, when large profits are to be realized by the importation of grain, the British merchant, be his ordinary traffic what it may, immediately turns aside from it, and invests his capital in grain—and such is the extent of his credit, that he can augment his capital almost at will, and before his bills at 60 or 70 days' sight are due, he has brought his cargoes from the Baltic, and other continental corn markets, and disposed of them to the inland dealer.

How differently circumstanced is the grain trade in South India. The whole trade is shackled by the trammels of caste, and of usage, which

confine it in a great measure to a limited number; and the native merchants of the Madras Presidency have little of the energy and enterprize, which characterize the European trader, and which could fit them for the task of meeting the emergency of a famine demand. To such a degree is this inertness carried, that rice may be selling at Madras at double its ordinary value, and be comparatively a drug in Tanjore, yet neither the merchant, nor the native craft-owner would think of attempting to bring up a single bag by sea, till the monsoon was favourable. And the whole coasting traffic of the presidency, so far as the native merchant is concerned, is at this hour regulated, not by the varying demands of the market, as by the monsoon—I might ask, what application has the reasoning of Smith to a trade so circumstanced?

As an instance of the manner in which native maritime traffic is carried on at this hour, I may mention the fact, that the master of a vessel leaving the port of Nagore with a cargo for the Eastward, on meeting with an adverse wind even within 24 or 48 hours sail of Penang, now immediately tacks, returns leisurely to Nagore, puts his vessel into dock, lands all the cargo, and patiently abides the favourable season of the following year, before he again attempts to take his cargo to its market.—This, and similar facts, furnished to me not as special cases, but as samples of the ordinary routine, afford sufficient proof of the present infant state of native commerce, and they are of great importance in their bearing upon the grain trade. For they go far, I conceive, to prove, that in this trade at least, where supplies cannot be waited for many days, it is not correct to assume as an established principle, as the government orders do, that the demand in the trade in South India always meets at the hands of the native trader with as full a supply as circumstances admit.

But the grain trade in this country, has not only to struggle against the want of energy, and enterprize of the small body of dealers to whom it is by usage confined: but even if they had the necessary enterprize, I would enquire, where, in the emergency of famine, are they to find the extra capital which shall enable them to purchase, and bring to market the requisite supplies at the high prices of dearth? Let us suppose that the average supply of rice for Madras is 10,000 garces in the year, and the capital required, when grain sells at its ordinary rate, 20 lakhs of rupees.—Owing to the scarcity, price rises 100 per cent, and the demand, in consequence of the more frugal consumption caused by high price, falls off 20 to 30 per cent—still large extra funds are required in the trade in order to bring the reduced supply to market *in due time*.—Where can the grain merchants now procure this additional capital. Their credit is not of that character, that private capitalists would advance largely,

even if capital was forthcoming, and as abundant in India as it is in England, which it is not. Unless then the Government afford its aid, by opening its treasury, and making large advances, how is the necessary supply of grain to be brought into the market *in time* to remove the scarcity, by the instrumentality of the native dealer alone?

Every successive dearth has demonstrated to us hitherto his inability; for in no district, has there hitherto been a timely importation, sufficient to avert famine. This, which I believe to be a well established fact, furnishes in itself a strong a priori argument against the correctness of the view of Government. As does also the fact, that although the trade is under British rule perfectly free, rice sells in seasons of scarcity in one district at eight or ten measures the rupee, and in another almost adjoining, at half that cost. Another proof, that supply, and demand do not now in practice, readily adjust themselves.—And there is I apprehend but one explanation to be given of this circumstance—that there is neither enterprize, nor capital in the corn trade at present, adequate to meet the large, and extraordinary demands of the market in districts where famine prevails.

The peculiar circumstances of dearth in this country, afford also additional arguments, against the views contained in the Government orders, and point to the necessity of the interference of the State. *The magnitude of the evil*—entire districts being involved in suffering at the same moment—*its extreme pressure* on the population—destroying even thousands in a few weeks—with the well known *limited means of* the native merchants, and their general inability, to undertake extensive speculations in distant markets,—all preclude the hope, that private exertion will be found sufficient to meet so great an emergency. We have strong confirmation of this, in the circumstances of the recent famine in this presidency in 1832-3. Rice was at that period abundant and comparatively cheap in Canara, Malabar, and elsewhere in our own provinces, when the famine was at its height in Guntoor; and yet, no supplies reached that province, in time to prevent its almost entire desolation.

Facts of this nature appear to me to demonstrate the duty of interference. And that it is not enough for the Government to offer the people work, and pay them for their labour, when the crisis of famine has arrived—trusting to the native traders' unassisted energies to provide the requisite supplies to meet the urgent demand for food—but they must, by a prudent foresight, and by their own energy, bring the abundance, and the stores of distant and foreign markets within the timely reach of the retail trade, or the pressure of famine will remain in full force, till the population is brought down to the level of the numbers, which the native trader can supply.

If these views are borne out by experience, they lead us to an inference wholly opposed to that assumed in the Government Orders; and in lieu of concurring in the opinion,—that "if the Government were "to throw a quantity of grain into places, which would not receive "it in the ordinary course of mercantile speculation, the only effect "of this measure, would be to convert a scarcity into a famine," I should almost be disposed to assert the reverse, and to maintain,—that at present in South India, whilst its corn trade, and trade in general are at so low an ebb, the timely and judicious interference of Government, instead of aggravating, is the only mode in general, by which scarcity can now be greatly mitigated and famine prevented. And that an importation of grain, through the means of Government capital, and possibly of Government agency, *from foreign or distant markets*, where there is abundance, into districts suffering from dearth, may be under the existing circumstances of the country a measure of sound policy; and the best, if not the only practical method by which the distress caused by the peculiar character of tropical droughts can be greatly alleviated.

It is no argument against an interference of this nature, to cite to us, as the orders of Government do, the fact, that native rulers in former times, participating in the ignorance, and in the prejudices of the people, have converted scarcities into famines, by the barbarous policy of compulsory sales, or other arbitrary interference with the capital, or with individuals in the trade. There can be no question now, as to the proper course to be pursued on this head: for Dr. Smith has placed beyond dispute the important principle, that the interest of the inland dealer and the public is the same, and the more free he remains, the better.

No interference with this branch of the trade is for a moment advocated: for if adequately supplied, the home-dealers it is certain, are fully equal to the due distribution of all the grain brought into a district in a year of famine, in as much as they distribute the larger supplies of abundant years. But it is in the importation—the foreign or whole-sale trade, that we would propose the interposition of Government. Not by any restriction on the wholesale merchant, or the importer, but by offering to him the assistance of Government; and by endeavouring to infuse into the import and wholesale trade a spirit of adventure and activity, adequate to meet the urgent and large demand of famine. And should this, after full trial, fail to place the necessary supplies in due season, at the doors of the retail dealers—then only by leaving the wholesale merchant to himself, and making use of a Govern-

ment agency for introducing for sale into famine districts only, timely supplies from distant and foreign markets, at the risk of Government; whilst the home, or the local trade should be left altogether to take its own course, and purchase large or small supplies as it might see fit.

The mode in which the interference of Government could best be effected, experience can alone determine. But on general principles, it would appear right to interpose in the first instance, by throwing Government capital into the existing grain trade, in the form of advances to native merchants, and others, who might be willing to import grain at their own risk, into districts threatened with, or suffering from dearth. This assistance has an advantage over the principle of a bounty as it furnishes the capital by which the supplies are to be obtained, and might readily be afforded, by authorizing Collectors to grant pro tempore, bills at favourable rates on the treasuries in those provinces, in which grain was abundant and cheap. To this should be added bounties on importation; and it might be also highly desirable for the Government to offer to the native trader peculiar facilities, either Government vessels or land carriage, for the safe transport of his grain to the districts where famine existed—that no impediment might arise to the introduction of his supplies, from the want of carriage, or from the fear of violence from a suffering population.

If these means failed, and it shall be found, that the native trader is not equal to the task of providing the extra supplies needed in seasons of famine, and that neither his credit, nor any securities he could offer, are such, as could warrant large Government advances to him,—then it would be no departure from sound principles, to employ a Government agency—for procuring grain from distant markets. The present course sanctioned by Government, by which its treasury is open to its Commissariat, to purchase up in one hour from the wholesale dealer, the entire stocks actually in the home market; whilst the retail trader is left, either without any supply, or to seek it from a distance, is now a practical interference of the worst kind, one which must greatly aggravate the distress. At Nagpore in 1833, it is reported to have instantly converted scarcity into an absolute famine—and it is not easy to conceive it to be a wise course even in a financial point of view. For the same supply, procured in the distant market, where grain had not reached famine prices, would it is probable cost less even with the carriage, than when purchased at scarcity prices. Instead of the present practice, I should be inclined to suggest, even though it might occasion loss to Government, that in seasons of great dearth, the Commissariat should be prohibited from

purchasing grain in the markets of those districts, in which famine prevailed; and that it should be required to import its supplies from places, where grain was comparatively abundant. By this means, the stocks of the district would be left available to the retail trader; and it is more than probable, that as the scarcity increased in severity, the Commissariat might be made instrumental in supplying from its stores the local market with *foreign* grain, at a cost, which should cover all expense of carriage, and yet greatly mitigate, if not prevent famine. I will not however pursue this subject—the object of these remarks is not so much to advocate particular measures of relief. But rather to induce a full examination of the doctrine laid down in the Government orders; and to endeavour to ascertain, whether it be an indisputable truth to be taught to all our native servants, that injury must invariably result from any interference of Government in seasons of dearth in this country. And to lead to the important enquiry, whether there are not, as Dr. Smith seems from his guarded language to admit, means open to the Government, which may not be improper for it to adopt in periods of drought, by which that most dreadful scourge, the absolute famines which now periodically desolate our provinces may be wholly prevented, and scarcity at all times greatly mitigated, without a departure from sound general principles, and at no great charge on the finances of the State.

III.—*On Improving Internal Communication in the Carnatic.*— *By* J. Kellie, Esq., *Assistant Surgeon.*

The expence of transport of goods from Madras to Trichinopoly, 220 *miles, is about* 35 *rupees, or* £3 10*s. per ton, which is nearly as much as the present price of freight from Madras to London.*—Captain Cotton's *Report.*

With the view of facilitating intercourse and giving a spur to commercial enterprize, it was some time ago in contemplation to construct an iron railroad betwixt Madras, and the large towns of Conjevaram and Wallajanuggur.

That the project was a most enlightened one, and would fully have sustained many of the expectations of its original projectors, all, who have regarded with attention the amazing benefits derived from similar undertakings in other parts of the world, must confidently have expected, and every one who takes an interest in the progress of civilization in

this our adopted country must regret, that any obstacle should have interfered with the execution of a measure pregnant with such numerous advantages to society. For, putting aside the more obvious and immediate benefits which would have been derived from such an establishment; no measure, with the exception of the diffusion of the English language, would conduce so much to diminish the immense space which exists between the inhabitants of India, and the European, and to inspire a general national feeling throughout the country, as facilitating intercourse betwixt cities and the towns in the provinces; the novelty and cheapness of regular and rapid communication, would induce numbers of inhabitants, who under other circumstances would have remained stationary, to leave their homes, and flock to the capital, "where the competition that takes place, the excitement that is constantly kept up, the collision of so many minds brought into immediate contact, endeavouring to outstrip each other in their respective departments, developes all the resources of the human mind, and renders a great city a perpetual radiating focus of invention and intelligence."*

The belief that principles of economy alone, and the little prospect of a direct remuneration commensurate with the great outlay of capital requisite for such an undertaking, influenced the members of Government in not giving their support, convinced although they must have been of the advantages which would flow from it—has induced me to address you, and to advocate a plan, by which all the great objects of such an establishment may be secured at a comparatively trifling expence, and at the same time is free from the numerous objections which in my opinion are necessarily attendant on iron railroads in India.

Iron railroads are constructed and maintained at an enormous expence, and are only suited to a country abounding in wealth, and which has arrived at so high a state of civilization as to render time a most valuable consideration and cause celerity of intercourse to be estimated beyond all price, and even then will only be attended by success if supported by a large influx of passengers, able and willing to pay for these advantages. For, it must ever be borne in mind that it is still a matter of opinion how far heavy goods can be conveyed along railroads with advantages to the proprietors, and that the great success of those established in England has arisen *entirely* from the conveyance of passengers.

In my opinion, which however I offer with great diffidence, iron railroads are not adapted to India, either as regards the present condition

* M'Culloch.

of the country—the genius of its inhabitants, or the stage of civilization at which they have arrived. India is essentially an agricultural country —but carrying on a considerable traffic between the coast and the interior, and which is in a state of great depression from the impediments to free intercourse; nothing therefore will conduce so effectually to raise it from its low estate as a cheaper mode of conveyance for its merchandise and raw produce. That expensive iron railroads would effect that change is more than problematical.

The saving of time is in the estimation of the natives of India a matter of very little importance, and strong indeed must be the prospect of gain, and small the fare to induce them to leave their present dilatory proceedings and various occupations to avail themselves of this new means of intercourse. Thus the main source of revenue in England, the conveyance of passengers, will, from the indolence and poverty of the great body of the inhabitants, form an unimportant item in the returns of an Indian railroad. There are other objections to their general introduction of no small magnitude.

1st. They would require to be laid down upon an entirely new line of road.

2ndly. An engineer who has directed his attention especially to this department could alone superintend the construction of iron railroads, and he would require to have a large body of iron workers to assist him in making, and repairing the rails, carriages, &c.

3rdly. No carriages but those of a peculiar construction could be used upon iron railways.

4thly. An efficient police establishment would be requisite along the whole line of road to protect such valuable property, and to prevent the rails being injured or the road obstructed.

5thly. By such a means of conveyance, there is immediate collision with the interests and prejudices of a large body of the natives, now employed as carriers, by entirely removing the means of transport from their hands.

6thly. The expence of maintenance. This item alone in the accounts of the Liverpool and Manchester railroad for blocks, "sleepers," "chairs" &c. amounts to more than £400 per mile!

Instead therefore of using bars of iron in the formation of the "way," it is proposed to substitute slabs of granite, each slab about 5 feet long and 1½ in breadth and thickness. These, if laid down perfectly level and having their upper surface even with the road, in parallel rows, and at such a distance apart that the wheels of the common cart will run in the centre of each row, will form a road possessing nearly

all the advantages of an iron railway, and constitute the one now recommended.

Ways of the above description, or tram-ways, as they are usually called, have been constructed in Italy of blocks of lava, and at Marseilles of granite, and the waggon road laid down by the East India Company, betwixt their docks and warehouses, is constructed of the same materials and upon the same principle.

It is unnecessary to remark, that the superiority of iron railways over turnpike roads arises solely from their being perfectly level, and smooth, and from their admitting of carriages being so adjusted, as to allow of their being propelled forward with great velocity by means of steam or horse* power, without the chance of escape: now it will at once be obvious, that a granite way gives all that is required in the first instance, and, as the *very rapid* conveyance of either goods or passengers ought not to be so much the object in this country, as the formation of a smooth, level way, composed of a solid material, and requiring little repair, admitting of the easy passage of carriages, and the consequent great saving of animal labour, the fixing of the carriage on the rail becomes a matter of very secondary importance; indeed, without that arrangement, it secures all the advantages of an iron railroad, *on which the carriages are dragged by horse power*, as no difficulty could be experienced in guiding a horse betwixt, or two bullocks along the two broad level strips of granite forming the road; and I presume the most sanguine in improvements can hardly anticipate the time when steam power will be used in India for that purpose!†

On the other hand, tram-ways would not originally cost so much as iron railways, *even when constructed under the most favourable circumstances;* they would require but little superintendence, and could be repaired when necessary by the common workmen of every village. They could with facility be constructed over the Carnatic on the roads at present in use, and, would offer no obstruction to the general traffic of the country, as they might be crossed and recrossed by native bandies without inconvenience or injury. Being adapted for carriages of every description, they would not abruptly interfere with the customs of the natives, and would, if they were so inclined, leave the transport of goods in their own hands—but, with this manifest advantage, that their oxen

* On the Edinburgh and Dalkeith railroad the carriages are dragged by horse power at the rate of 10 miles an hour.

† The original cost of a locomotive engine is about £800, and the repairs calculated at £1500 per annum!—Lardner on the Steam Engine.

would be able to drag a much heavier load. The accompanying figures and extract from Gordon on Loco-motion will shew at a glance the advantages which this description of way possesses over iron railroads :—

	Iron rail-road.	Granite tram-way.	Broken stone-road.
Tractive power required to move one ton on a level ...	10-lb.	$12\frac{5}{10}$ lb.	43-lbs.
Annual maintenance per mile.....................	£400	£5	£133

" Upon this road (the Commercial-Road tram-way to the E. I. Docks) Mr. Walker found, that one powerful horse was able to draw $30\frac{1}{2}$ tons, upon a level, at the speed of four miles per hour; but the exertion of the horse was too great to be continued for any considerable time; and hence this must not form a basis for calculation. Mr. Walker has however shown, that upon a level, ten tons gross may be considered a proper load for a draught horse."—"The facility of turning off and on such a road, and of crossing it, the advantage being unconfined to any one species of carriage, or branch of trade,—being open to all,—being $\frac{9}{10}$ths cheaper in construction than any railway,—and costing for annual maintenance less than $1\frac{1}{4}$ per cent of the acknowledged sum required to maintain the Liverpool and Manchester railway, compensate amply for the mere difference of tractive power."

I have thus endeavoured, however imperfectly, to point out the comparative value—the advantages and disadvantages of these two descriptions of "roads." The one in my opinion combining in its formation cheapness, simplicity, and efficiency, proportioned to the present state of society in India, the other, complicated in its construction, enormously expensive, and immediately interfering with the prejudices and interests of a large portion of the inhabitants. Iron railroads are undoubtedly the most scientific means of transport yet known or probably that can be devised, but their great cost &c. is a bar to their introduction in India. Tram-ways stand next in importance, and may be used with advantage when the poverty of a country or small traffic will not justify the construction of an iron railroad.

However, the superiority, and the advantages which would flow from such a means of communication could only be fully developed, and

demonstrated to the inhabitants, by the establishment of a regular and a speedy system of conveyance upon them. If we rest satisfied by placing at the command of the natives such an improved means of intercourse, and content ourselves, by simply levying a toll on all carriages which take advantage of it, no one will doubt but that the grand objects of such an undertaking would not be obtained, that few of the evils which press so heavily on the internal transport of the country would be removed, and the civilizing influence of the measure would be entirely defeated.

The advantages of such an establishment can only be worked out by European energy and European talent, by men who are convinced of its expediency, and who are well acquainted with the incalculable benefits to society which can be extracted from it. Under their direction, light vans would be established for passengers, and cars for the transport of heavy goods. The natives would by degrees discover the superiority of such a mode of conveyance over that at present in operation, in cheapness, rapidity, and regularity, it would gradually be taken advantage of, and might ultimately become the sole channel of internal communication. By this means an impulse would be given to internal commerce hitherto unknown, and thus would be consummated a measure of vital importance to this portion of India, and one considered essentially necessary for the proper development of the resources of every country.

It were superfluous to point out in detail the various advantages which India would derive from the formation of roads admitting of such easy intercourse, as there is not an individual who would not be directly or indirectly benefited by their establishment, and above all that portion of the population would derive the greatest advantage, who stand most in need of assistance, the cultivators of the soil. In this as in other countries, they form the most numerous and important class of the inhabitants. But in India, in place of the intelligence and industry observed in other countries, the ryot through long oppression, is sunk in poverty, ignorance and apathy, and hardly an effort has been made to raise him from his degraded condition. The formation of such excellent roads would operate immediately in his behalf, by enabling him to bring the produce of his land with facility, to the best market, at the least possible expence. By such means he would be rendered independent of the travelling merchant, the hope of gain would stimulate him to exertion, and that apathy and languor, which are the invariable concomitants of poverty and want of hope, would give place to energy and enterprize. In his journies he would become familiar with new objects, and would be inspired with the desire to obtain them, which

would again act as an additional incitement to renewed exertion. On being brought into collision with the inhabitants of the towns—his mental deficiences could not fail to be made apparent even to himself, and to prevent his children being over-reached by the superior acumen of the citizen, education would necessarily be resorted to. Thus in the train of knowledge all the blessings of civilization would be diffused over the country.

Should the above plan be considered worthy of examination, a committee of gentlemen might without much difficulty collect information on the subject, sufficient to enable them to form an estimate of the expence per mile, on a line of road in the vicinity of the presidency. For example, from Madras to Arcot via Conjevaram and Wallajanuggur. The following rough estimate, for raising a road and constructing upon it a tram-way, may serve as a guide to future enquiries ; but I need hardly remark that it is only by an accurate survey of the line of road on which the way is to be formed, that any thing like an approximation to truth can be arrived at:—

Cost per mile.

2,112 prepared granite slabs 5 feet long.............	Rs. 2112
Levelling, laying down slabs, &c......	583
Bridges	300
Carriage..	675
Sleepers	62
Incidental expences............................	100
	Rs. 3832

As the road betwixt Madras and Wallajanuggur has already been partially raised, and levelled, we may expect that the formation of a tram-way upon it would cost considerably less than the estimate I have formed, but taking Rs. 3832 as the average cost per mile—

60 miles the distance betwixt Madras and Wallajanuggur will amount to..	229,920
Cost of oxen, carriages, &c. estimated at..........................	53,200
Total cost Rs.	283,120

To justify the above outlay of capital the following is the annual amount of traffic, and its value, on the line of road above alluded to, taken from Captain Cotton's valuable report:—

Traffic.

Fuel	40,000
Straw, &c	5,000
Grain	5,000
Goods	20,000
Passengers, &c. equal to	5,000
	75,000

Present expence of this traffic at 6 Rupees per ton Rupees 450,000

It may be fairly conceded that at least one half of the above traffic, valued at Rs. 225,000 per annum, would pass along the way. Estimating therefore, the current expences of the establishment at Rs. 58,200, there will remain a balance of 166,800. A sum more than sufficient to remunerate liberally the proprietors, and provide for all contingent expences.

However encouraging the above estimate may be of the probable results of such an undertaking, I feel convinced that from its novelty, few private individuals, whether european or native, would be induced to embark in it, without in the first instance obtaining a promise of support from Government. In other countries the state grants patents and monopolies as a recompence for undertaking expensive experiments, of which the public is to reap the benefit. I therefore cannot but confidently expect that Government will approve of, and afford the most efficient assistance to put to the fair test of experiment, a measure supposed to carry in its train the amelioration of the natives over whom they rule. Of its rapid and complete success there can scarcely be entertained a doubt; and a probable consequence of success would be that other companies would spring into existence, and be incited to embark in similar undertakings, " a superior description of roads would thus be introduced over the country, and one rupee would not in future be required from Government either for their execution or support."

It is unnecessary to remark that the roads at present in use in the Madras presidency, are, with a few exceptions, of a very indifferent description, and it appears to me that with reference to the climate, their construction is essentially defective. Every shower loosens the soft materials of which they are composed deep ruts are speedily formed, water collects which sinks down and softens the whole mass to its foundation, and if the road is not immediately repaired, it is by the next fall of rain, utterly destroyed. Tram-ways by preventing the

road being cut up by carriages would in a great degree obviate these defects.

It therefore becomes a subject worthy of consideration, whether it would not be preferable to encourage by every means in our power private individuals to construct granite ways from which a direct revenue would be yielded, than to continue forming common roads at a very great expence from which no pecuniary return is received, and from which very partial benefits to the country are derived. Government have already expended immense sums of money in the construction of roads,* but the necessity of granting a small annual sum for their occasional repair has unfortunately in many instances been overlooked; by such a course of policy and economy, works of the greatest utility, the labours of years, have not infrequently been rendered entirely useless in a few months. The time of the civil establishments is too much occupied to admit of their bestowing that attention to the subject which its great importance demands, and I presume Government are not prepared to establish superintendents of roads, with all the necessary appliances, throughout the presidency. It has therefore evidently become necessary in working out the regeneration of India, for Government to avail themselves of other agency than that over which they possess immediate control, and to delegate their authority and interest in the execution of measures of improvement to the inhabitants themselves, to stimulate them to exertion by holding out honourable rewards—affording them every information requisite for such undertakings, and withholding no aid that will tend to combine them together and induce them to identify themselves with every measure having the prosperity of their own country for its object.

The formation of Joint Stock Companies will at once effect every thing that is desired. It is to them that England is indebted for her railroads, canals, and indeed for almost every establishment of great public utility, carried on as they are by the combined capital and energies of large bodies of individuals. In India, roads constructed by such agency would create a description of international property, in which influential natives, both at Madras and in the provinces, would become partners; such a coalition would not be unattended by its own peculiar advantages, in softening down the distinctions of cast and colour, and of presenting opportunities of introducing with effect other measures of usefulness amongst the native population.

* The high road from Masulipatam to Hydrabad, a distance of 220 miles, has already cost 8¼ lacs of rupees!—and the road from Madras to Poonamallee a distance of 9 miles cost Rs. 450,000.

It may be urged in opposition to the above measure, that the line of road will require to be as carefully levelled for the formation of tram-ways, as for the construction of an edge railroad, and thus one of the most important items of expence in their formation will be found equally necessary. There can be no question, that, as we approach a perfect level in the construction of the "way," the more will it approximate to the perfection of an iron railroad, but, from the nature of the Carnatic, a perfect level in most instances will be very easily attained—and embankments for that purpose will be no further necessary than would be requisite in the construction of a good common road; but, when elevations of any magnitude did occur, the removal of which would entail much expence, an inclined plane might be formed and relays of cattle kept for the purpose of affording assistance. By such an arrangement that objection will in a great measure be removed, while we secure at a moderate expence a most excellent description of road—formed on so firm a basis, of such weighty and solid materials, as to defy the effects of the monsoon, and in other respects to be peculiarly well adapted to this country.

Such are the views which have occurred to me on the subject of internal communication, and the Carnatic presents peculiar facilities for carrying my suggestions into execution, being nearly a perfect level, and abounding in the requisite material. In submitting them, my sole object has been to draw attention to a subject of acknowledged importance, and if roads of the above description were made to intersect the Carnatic, few will be so bold as to doubt that in a few years they would effect an entire change in the statistics of that portion of India.

MADURA, 20*th November*, 1838.

To the Editor of the Madras Journal of Science.

MY DEAR SIR,—I have the pleasure to send you herewith a brief but masterly review of the relative cost and advantages of iron rail-ways and tram-ways as compared to common roads. The author has here shown, beyond all question, the vast preponderance in favour of tram-ways as regards first cost, facility of construction, and durability over iron rails: while, as a means of facilitating transit, they nearly equal them, and excel roads of the common construction by 250 per cent. with the almost incalculable advantage, for this country, over edge-rails, of permitting the free use of all kinds of wheel-carriages the same as on the common road.

When the paper first reached me, I took the liberty of showing it to an influential person, and requested the favour of his opinion as to the propriety of bringing it forward, in such a way, as might perhaps lead to the plan proposed being tried on a few miles of some much frequented road.

This gentleman, though fully coinciding in my opinion as to the beneficial results likely to flow from the adoption of such roads, yet seemed to think, as I understood him, that the expense would prove a bar to their adoption. I was not then, nor indeed am I now, prepared to show by comparative statements that the first expense of laying such a road would not greatly exceed, if indeed it did not actually fall short, supposing Mr. Kellie's estimate nearly correct, of the cost of forming a good road of the common construction. This could be easily ascertained in Madras where the tear and wear of roads is great, and road making and repairing in constant practice. According to Mr. Gordon's table, quoted in the paper, the tear and wear of an iron rail-road is 80—and of a broken-stone road 26 times greater than that of a tram-way, hence, were the cost of making a tram-way 20 times greater than that of a common road, it would still prove the cheaper of the two, leaving altogether out of the question, its superiority as a means of transit. Can more conclusive evidence be adduced in favour of the plan than this table affords?

The destructive tendency of our monsoon is alleged as an objection to this kind of road, this is at best a speculative objection, common roads are well known to suffer most severely from this cause, tram ones have never been tried, and there seems every reason to believe that the massive materials of which they are composed, will effectually counteract causes of destruction, to which loose materials offer no resistance.

I have already remarked that I do not know the average expense of laying a good broken-stone road, but according to Mr. Kellie's estimate, which was submitted to a very able engineer, and who thought it a "roomy estimate," the cost of a tram-way of two lines of stone is about 16 inches for the rupee; and supposing we add 168 rupees to the estimate to give us in round numbers 4000 per mile; we should still have 15 inches for the rupee, at which rate, I question if we could thoroughly break the stones required to make so much really substantial road, 8 feet wide, exclusive of the charges for carting and laying them in their place: and when placed, they require constant attendance to keep them there, if it happens to be a much frequented road. When to these drawbacks we add the difference (250 per cent.) of tractive power required on such roads, I think a very strong case has been made out for giving the plan the benefit of a trial on a considerable scale, and if the result, is

at all commensurate with the calculations, we may reasonably hope, soon to see the plan extending itself in all directions. In this part of India where we have no water carriage, by which to bring the commercial produce of the interior to the coast, good roads are indispensable to its prosperity, and would prove not less advantageous to the native population, than profitable to the European community by the extended mart they would open for the introduction of British manufactures, but which is now nearly closed, through the imperfection of the means of intercourse.

If you can find a place in the Madras Journal for these remarks their insertion, will much oblige.

Dear Sir, Yours truly

ROBERT WIGHT.

IV.—*Geology of Bangalore, and of some other portions of Mysore.—By* JOHN CLARK, ESQ., M. D. *Assistant Surgeon,* 13*th Light Dragoons.*

It is the remark of the eminent philosopher and physician Sir Thomas Browne, that the world was made to be inhabited by beasts, but studied and contemplated by man. The world is here referred to in a general sense, including the whole world of nature—not in that local and limited sense in which the geologist would view it, who may literally be said to study and contemplate the world—the earth—the matter of which it is formed, and the arrangement of all its parts. It is only however that portion comprehended in the command of its great Creator "and let the dry land appear," which employs the study and contemplation of the geologist. That which the ocean covers, is, like many mysteries in the science, hidden from our eyes, although still open to conjecture. How a world has been formed, is not so much the study of the geologist, as how it has been altered—and two modes have been pursued in investigating this subject—that by conjecture, and that by observation. The first was much employed in the infancy of the science, and the last has happily replaced it. It is only by observing the changes constantly taking place, and the forces or causes which may lead to these changes, that correct and philosophical data can be established. Too much must still be left to conjecture, and it is extremely easy by a well developed organ of constructiveness, to form a

world within our little minds, and alter it by our puny imaginings—a world built indeed upon a sandy foundation. Of the conjectural manner of explaining things, such *has* been, although such is not now, the tendency of the science, and it is our inability to enter into the mysteries of time and eternity—the impossibility of throwing the mind back to that beginning when light shined out of darkness, and of understanding the forces which then operated, that has attached to geology the character of not being one of the exact sciences. The "light which shined in darkness" we only darken by our comments, and it is with us as with the darkness which Scripture tells us "comprehended it not."

In the history of the earth there are but two grand geological facts recorded—its formation and its submergence for a time under water. The universal flood, taken so much into consideration in accounting for the present appearance of the earth, has, perhaps, in its influence, with reference to this portion of the globe, been over estimated—may it be supposed that there was a sudden subsidence of the waters from this the Old Continent, leaving it as it came from the hands of its mighty architect, *ready to be again peopled*, and that there was a gradual retirement of the waters or of the ocean from the new world, with new depositions, and as it were fresh creative bursts—forming and reforming. But leaving what *has* occurred, to what is daily taking place, something may be here said of the agents now in operation which may have altered the surface of that part of the country, the mineralogical features of which are about to be described. And first of decomposition, and its chief agent heat—as the human constitution is susceptible of the effects of heat, so are the rocky masses which cover the country and are hourly crumbling into earth. The rays of a tropical sun act so powerfully that a rock when touched communicates to the hand a burning sensation, and the consequence of this heat, is a state of expansion. As soon as by the setting of this powerful luminary, the great agent in expansion, the cold evening breezes begin to affect the heated rock, condensation follows; and this daily process of expansion and condensation carried on for ages establishes a crack which increases till whole masses are separated. This process of the elements is the one pursued by the natives in quarrying, as they invariably burn logs of wood over the rock to produce a state of expansion, and then sometimes but not always throw cold water upon it—an excellent example of man in total ignorance of the laws of chemistry, observing and imitating the simple laws of nature. These cracks are frequently both perpendicular and horizontal, separating immense cubic masses from each other, the fantastic and irregular appearance of these arising afterwards from unequal decomposition—

some portions undergoing rapid decomposition or resisting it altogether. Many small granite rocks, much exposed to the influence of the weather, exhibit on their surfaces fissures both perpendicular and horizontal, dividing them into small cubic masses, showing distinctly on a small scale the mode of decomposition and separation. It may be remarked, that even the earth from the decomposed rock, when again in some measure by the influence of the sun consolidated into a sort of hardened baked earth, exhibits similar fissures.

Oxydation or oxygenation is another process by which the earth's surface in India is undergoing a great change. In my paper on the lateritic formation this was entered into at some length. To hyper-oxydation and decomposition are owing the lateritic, lithomargic and *intermediate* formations. The lateritic formation is of two kinds—one arising from the hyper-oxydation and decomposition of a rock in *situ*, and the other, from the decomposed materials being afterwards carried by water to a distance, forming a species of detrital laterite. Over the country in every direction, but chiefly in the neighbourhood of the cantonment, deep water-courses or nullahs exist, formed apparently in the following manner, and prevail where the soil is of a red demi-lithomargic character. During the very hot season, the sun acts so powerfully as to produce fissures and cracks all over the ground, and during the rains the water rushing along passes down into these fissures, and large massses of earth give way, forming in time these nullahs or water-courses, which generally terminate in tanks. Tanks abound all over Mysore and are extremely dirty and muddy, and contain a great deal of fine soil, carried thither from the neighbouring fields. The decomposition of rocky eminences into soil, and the delivery of this into the valleys by the rush of water, must tend to establish a more level state of the country.

Near many of these tanks, or where tanks have once existed, the kunkar deposit is often found. Between Mundium and Madoor, on the high road to Seringapatam, there is a very extensive valley, where kunkar is seen accompanied by the black cotton soil; and close to the Mundium tank, in the dry season when the water is low, an impure carbonate of soda and muriate of soda cover the ground like hoarfrost, and small calcareous nodules the size of marbles are intermixed with it. A very interesting question now intrudes itself, viz. how is this kunkar formed? and next to the laterite formation, is the most important with respect to Indian geology.

Kunkar, so universally distributed over India, is considered to be a species of calcareous tufa, divided into that of old formation, and that

which is daily forming. Professor Jamieson says "The first, (the old), "appears to have been deposited from the waters of lakes that formerly "existed in limestone districts, but which have long since disappeared." Of the last he says "The waters which flow along the surface of the "globe and which are charged with calcareous earth, deposit it on the "districts they traverse, and thus form tufas which are either porous "or compact, and are of the newest formation." The best example of the old formation I found in the neighbourhood of Goondlepett, about 30 miles from the bottom of the Neilgherries, and extending towards Mysore. The country there is flat, with few undulations, and with the appearance of having perhaps once been much covered with water. The calcareous tuff in that locality, is either compact, or loose and earthy in texture. The compact I found on the road between Goondlepett and Sindhully, jutting out about 2 or 3 feet from the ground in rounded masses, and sometimes with a most irregular and almost pisiform surface. On being broken into, it showed in the most compact specimens a sparry semi-crystaline appearance, with round darker coloured brown spots—in many of the specimens crystals of quartz were imbedded or attached, and some had a cavernous appearance. It might almost be called a calcareous conglomerate, and answers exactly to that described by Colonel Cullen as existing at Cuddapah, forming many of the inclosures, which indeed it did here. The softer and more earthy kind of kunkar I found in the ditch at Goondlepett, immediately under the soil and covering hornblende and actynolite slate; and an excavation inside the fort showed the same—a bed of kunkar, of a water-worn, irregular and almost coralline appearance. Some of the specimens in the ditch were of a brown approaching to red colour, with pieces of hornblende and actynolite imbedded, described by Dr. Benza, and forming as he says a real breccia. In the rocks, of which the fort is constructed, are some of calcareous spar, and it is more than probable deep sections in the surrounding country would show a limestone rock.

In districts such as this, where the old calcareous or rather kunkareous formation exists, and in many places in India where limestone abounds, the modern kunkar formation can be satisfactorily accounted for. But there are many tracts in India and in Mysore where no trace of ancient kunkar is to be found, and where there are no limestone rocks. How then it may be asked can we account for the formation of this kunkar? Long did I endeavour to do so, but in vain, until a deep section near the road between Mundium and the French Rocks opened up to me some views on the subject. In the section there was decomposing gneiss with beds of hornblende slate, and thick veins of a calcareous substance

somewhat resembling kunkar. In a valley immediately below, there was much kunkar, and a calcareous and clayey soil prevailed for some miles before reaching this place. Near Periapatam, which is not far distant from Coorg, other veins of the same kind were observed, which first directed my attention to the mode in which the far famed black soil of India may be formed. Are these veins from the decomposition of calcareous spar, which we know occurs frequently in hornblende slate? Wherever I have found much kunkar I have remarked that very few rocks elevated themselves above the surface, most likely all of them having undergone decomposition, and the ground has generally looked as if it had once been much under water. I think also that the formation has existed generally in a hornblende neighbourhood—an analysis of hornblende shows that much lime enters into its composition, and perhaps an analysis of hornblende rocks in India might show a larger proportion than even what is met with in Europe. In districts, then, where this ancient kunkar exists, or where limestone abounds, we are able to account for the modern formation, as the calcareous material is afforded, which water takes up and again deposits; but in these localities, where neither ancient kunkar nor limestone is to be found, the only mode of accounting for it, is by taking into consideration the calcareous veins in the decomposing rocks, as seen in the section above mentioned, or allowing for the decomposition of hornblende and granite rocks, containing carbonate of lime. The celebrated Voysey, in his second Report on the Geology of Hyderabad, says of the granite "in several places I have found carbonate of lime a constituent, the quantity very small and only to be detected by effervescence in acids, and a tufaceous limestone is found through the granite in nests and beds."—He again alludes to it as "veins of an earthy carbonate of lime."

Kunkar of an ancient formation has just been described, and one of its localities in Mysore mentioned; but there is another kind found in nodules a few feet below the soil, not in large masses or forming a conglomerate or a breccia. I have found it connected with a black soil, and much hornblende on the surface in small decomposed pieces. These nodules are carried away in baskets to the kilns, and when burnt afford chunam or lime for architectural purposes. I believe it is not considered a very fine kind. The modern formation of kunkar is common, and is found either in small pieces, the size of marbles, strewed over the ground, and sometimes along with an impure carbonate of soda or muriate of soda. or in larger pieces several feet below ground, accompanied with much clay—one locality of this last, about 8 miles from Bangalore, at Madapullay, on the Madras side of Kistnarajaporum, I may here describe.

The nodules are found about the depth of seven or nine feet from the surface. There is first a whitish brownish earth to about the depth of two feet, then about a foot of white clay, to this succeeds a blueish clay, intermixed with a little reddish earth to the depth of 4 or 5 feet, and a blueish whitish earth or clay with lumps of kunkar imbedded in it. There is apparently always much clay connected with the modern formation, and it is likely an analysis of the rocks in the neighbourhood would show a superabundance of felspar with a considerable proportion of carbonate of lime. It is probable also that some chemical action is constantly at work, not by us well understood, but perhaps in some measure similar to that which leads to the formation of saltpetre. Besides this modern formation of kunkar in nodules, I have seen it as an earthy deposit upon rocks in one of the large branches of the Cauveri.

Before leaving this subject I may allude to the existence of small mounds in many parts of the country, and detached fragments of a substance resembling bone: of a white colour and cancelated structure, and considered by the natives to be the burnt bones of giants, and called asurhar or giant's bones. Mention is made of these by Buchanan—and a note upon the subject will be found in the Journal of the Asiatic Society of Bengal for December 1835. Lieut. Newbold, in the October number of the same Journal for 1836, gives an account of substances of a calcareous and siliceous nature found near Bellary, and in the 18th number of the Madras Journal of Science some observations on the same will be found by Dr. Benza and Mr. Cole. Buchanan, Benza and Cole consider them as specimens of calcareous tufa, which some of them most certainly are, but specimens answering to their description were brought me, picked up about twenty-four miles from Bangalore, which were of the same peculiar cancelated structure like bone, but they did not effervesce with acids—they are siliceous and approach closely to, if they are not a coarse kind of semi-opal in a decomposed state. It is necessary therefore to divide these substances so much resembling burnt bones into the calcareous and the siliceous, the last of which appear perhaps to be a sort of opaline siliceous sinter.

The soils around Bangalore and generally in Mysore, may be divided into the black or cotton soil, not common in this part of the country—2d. A rich red soil from the disintegration of rocks containing much iron-like hornblende.—3d. The common or reddish brown soil, where perhaps the iron is in a state of protoxide.—4th. A white siliceous unproductive soil, and.—5th. A clayey soil found in the valleys and below tanks. Besides these five, there is another seen to the south-west of the fort, near a small range of little hillocks of a chlorite rock contain-

ing much iron, the colour is a light rich red. A soil similar to this is to be found between Mysore and Goondlepett, and seems to arise from the decomposition of chlorite slate with an admixture perhaps of hornblende and oxide of iron.

The black cotton soil occupies, according to Dr. Heyne, four-fifths of the Peninsula of India, and the cause or causes which lead to the formation of this soil form an interesting subject in Indian geology. It was referred by Dr. Voysey to the decomposition of a basaltic trap. A passage from some notes kept during a late geological tour bears upon the present point. "Started for Periapatam-road through jungle for four or five miles—soil black, occasionally red.—After this jungly tract, the road passes through a flat country, containing a good deal of black soil, having small pieces of kunkar on the surface, and much impregnated with saline matter. Just before entering Periapatam there is a deep water-course, with masses of basaltic hornblende lying exposed. This section shows for about three feet, the black soil so prevalent over this part of the country—succeeded by a reddish yellow earth, in which were rounded masses of basalt or basaltic hornblende—below this again was gneiss in a decomposing state, containing veins of a calcareous substance similar to what was before described, and having a vertical position." Here then was basaltic trap decomposing into a reddish or rather yellowish earth. How then could it form the black soil which was above? I can only answer by saying, that further on at the bottom of Coorg, I found the same black soil and some way up, but it changed then to red without any particular change in the rock. Now having observed much kunkar for some time before reaching the bottom of these hills, I asked myself the question, whether this black soil did not originate from a jungly country being covered for some time by water, or whether it was not the result of a calcareous admixture. In many parts of the country where this soil exists I have found kunkar beneath, as at Hoonsoor and Yelwall. Hornblende and basalt, as before observed, are constantly seen decomposing into a reddish or yellowish earth, highly ferruginous; and when they do form into the black earth, is it from the quantity of calcareous matter which we know these rocks often contain? or is it from the admixture of calcareous and ferruginous matter, making this far famed soil to be of a calcareo-ferruginous nature. By analysis it has been found to yield chiefly lime and iron, and its very name of cotton ground, from that plant flourishing in it, is in favour of its calcareous origin, for the soil most favourable to the growth of cotton is that which contains a very large proportion of lime. Does not this view of things reconcile the apparently conflicting opinions of Voysey and Benza. Dr. Benza

says "since neither sort of basalt found at present in Central and South "India, decomposes into a black soil, what kind of trap and under "what circumstances different from the present, could this basalt give "rise to such a different product? Is the general opinion of the black "soil having resulted from the decomposition of the basalt one of those "that are repeated only because once told." It appears to me that the kind of trap decomposing into black soil is that which contains much lime; for on the Neilgherries, where it decomposes into a yellow clay, no lime has been found; but in the Hyderabad district, described by Voysey, he mentions as one of the peculiarities of the part, the abundance of the carbonate of lime with the wacken, the basalt &c. &c. &c. and in another place he says "carbonate of lime is intermixed with the rock whether sienite, greenstone, granite, basalt or wacken."

Bangalore is situated on one of the most elevated ridges of the high table land of Mysore, nearly three thousand feet above the level of the sea. The principal rocks in the neighbourhood are gneiss, granite and trap, the formation being entirely primitive. The grand fundamental rock all over the Mysore may be called a sienitic gneiss, for where deep and extensive sections are opened up to view, the rocky masses are distinctly stratified, and contain more or less of quartz, felspar, mica and hornblende. In these sections sometimes beds of quartz and felspar only meet the eye, forming a pegmatite—then again we may find quartz, felspar and mica, forming a true granite or gneiss, and then beds of hornblende and felspar, or hornblende and quartz, forming a hornblende slate.

All the strata around Bangalore, and also throughout Mysore, run more or less north and south, sometimes north-west and south-east, or north-east and south-west, and the trap dykes and basaltic dykes or veins, which are numerous, and cut through the gneiss, have an east and west direction, but sometimes, as near the Madras road, before entering the cantonment, north-west and south-east. A mass of gneiss, about a mile south of the road, and about two from the village of Ulsoor, runs north-east and south-west, and a basaltic dyke cuts through it, running about north-west and south-east or rather N. N. W. and S. S. E. Some very large nullahs, principally towards the west end of the cantonment, one, two or three miles distant however, show well the constitution of the decomposing gneiss, better than can be seen on the surface, where only the more solid and less perishable portions of the rocks remain. In these nullahs we meet with crumbling masses of felspar—large beds of mica or hornblende, and numerous veins of quartz. The common colour of the mica in the undecomposed rock is black, but exhibiting a variety of shades in decomposition—first, it becomes of a brownish

yellow, then a yellow with a tinge of green, and finally it assumes a sort of sulphur yellow or siskin green, the scales of mica scarcely perceptible. When, however, the mica is in contact with or near a vein of quartz, it becomes of a pinkish hue, most likely from the higher oxydation of the iron in the quartz. Immense masses of mica are often seen lying at the bottom of many of these nullahs, and feeling very greasy when touched—indeed mica in many parts of Mysore is very greasy in decomposition, approaching to talc, a talcose mica, or passing into chlorite.

It is perhaps the decomposition of a species of talc-mica with felspar, which affords the very fine white soft and greasy earth found in some of the nullahs, called by the natives shidi munnu, and used occasionally for white-washing their houses. In looking at the different appearances of decomposing mica in the nullahs, one is led to believe what Dr. Thomson says " that it is pretty evident more than one species is at present confounded together under the name of mica, though we have not yet data sufficiently accurate to separate them with accuracy from each other." Magnesia he mentions as one of the constituents of black mica, and it is very probable that magnesia enters into the composition of the micas generally through Mysore, for potstone, a magnesian mineral, is very common through the whole country, although not so in the immediate neighbourhood of Bangalore. The mica and felspar are both very abundant in the gneiss rocks—the mica, as mentioned above, generally of a black colour, and is dispersed through the rock, or in nests or even beds, and sometimes in very small thread like streaks. I have observed when there are large beds a good deal of golden mica is mixed up with it. The felspar is generally white, but frequently of a reddish tinge. The large crystals are often of a light red or pink colour, and when there is nearly a total absence of mica, and the rock approaches to or becomes pegmatite, the reddish felspar predominates.

What is called red granite by Dr. Buchanan I have found in several places in Mysore. I picked up a few specimens to the west or south-west of a very fine bund near the fort—there were no rocks of it, but merely some pieces lying on the ground—the rocks having undergone decomposition. The second place I have met with it is between Closepett and Chinepatam,and the third place between Mundium and Seringapatam. The specimens vary a good deal, but the quantity of felspar of a red colour is very great, and this felspar is of a clayey aspect and peculiar. The specimens from near the bund are alone of this red clayey looking felspar, with glassy quartz, making it a pegmatite. Those between Closepett and Chinepatam are of looser texture, consisting almost altogether of this clayey looking red felspar, with a few crystals of quartz, and numerous

small cavities of a yellow earthy powder, decomposed hornblende, or perhaps iron? Another kind is porphyritic, large, crystals of felspar imbedded, with the same microscopic cavities, this being the rock which Dr. Benza says he is at a loss what to denominate.

Not far from Seringapatam, are some rocks near the road, about 4 miles before entering the town or rather fort, consisting almost entirely of the red clayey looking felspar, with numerous small cavities of a black shining metallic looking substance, what in decomposition seems to afford the yellow earthy powder. This is a rock which I should think has at one time been rather common through Mysore, but has rapidly undergone decomposition, as it appears to contain a good deal of iron. Whilst on the reddish felspar I may mention that there are some gneiss rocks near the gardens of the Horticultural Society, where I have found occasionally some very beautiful specimens—the felspar and quartz of a pinkish tinge, with green streaks and lines, dark green needle-shaped crystals of, I think, epidote, with occasional crystals of kyanite. The next ingredient in the gneiss rocks is the quartz, which is usually of a white colour or having a very slight blue tinge, generally the first when with felspar, and the last when in veins by itself. The light blue sometimes approaches almost to an amethystine colour—small pieces of rock crystal are sometimes picked up, one fine specimen in my possession, containing iron pyrites, was found in some rocks about two miles from the fort. In a small nullah about a mile and a half to the north of the Belfry, and near the boundary hedge of the cantonment, there are large quantities of quartz crystalized into six sided prisms terminated by six sided pyramids. The hornblende, which is found in beds in this gneiss, is seen in the nullahs decomposing into a greyish or greyish green earth.

Gneiss is the prevailing rock around Bangalore, and is generally of the common grey colour, with nests and streaks of black mica, large veins of foliated felspar and quartz, and the strata often very much contorted. The process of decomposition is proceeding rapidly, and where a deep ravine exists, this decomposition is well shown—an immense rock will be found retaining its shape, but quite soft and crumbling down on being touched, veins of quartz traversing the soft disintegrated mass in all directions. In digging to any depth, as in forming wells, after removing a few feet of a brownish earth, we come upon the gneiss rock in a state of decomposition, forming a white stony earth. In the valleys all around, the felspar decomposes into clay, which is used by the potters and chatty manufacturers. Where a bed or vein of quartz highly ferruginous has existed, a quartz laterite has been formed, as on the left-hand side on going towards the fort near the Canarese school

establishment of the Wesleyan Missionary Society. A small village is built upon this kind of laterite, which differs much from that on the western coast, but is somewhat similar to some specimens obtained at Coorg. In some places, as towards the west end of the cantonment, near the very last building appropriated for the stand of arms of a native corps, a thick bed of pebbles is seen below the soil, forming what Dr. Benza would call a lateritic or quartzy detritus.

The highest hills in the immediate neighbourhood are about 4 or 5 miles from the fort to the south of the Kingaree road—these hills run north and south, and are of gneiss and granite with occasionally hornblende slate in the declivities. Hornblende slate is found in several spots jutting out of the soil, chiefly on the west side, its principal locality is in the direction of Kingaree, and near the high hills just spoken of. Basalt is pretty common either in dykes or veins, and, also chiefly to the west, trap dykes the same. These last I shall now describe, but it may be as well first to observe, that there are four principal roads leading into and out of the cantonment—the east or Madras—the south-west or Seringapatam—the south or Trichinopoly and the north or Nundidroog and Bellary. Besides these, there is one about due west, leading to Severndroog, and another about north-west leading to Sera and Chittledroog.

About 8 miles on the Madras road, close to a village and valley where there is much kunkar, and from whence Bangalore is chiefly supplied with chunam, there are several hornblende rocks near the road, and a range of the same is observed running about north and south. This range of trap rocks runs for many miles. On descending the last hill but one on the same road, before entering the village of Ulsoor, and about a mile and a half from it, a trap dyke is observed on the right-hand side. If we now leave the road and turn off to the left in a southerly direction, on a line with this dyke and about half a mile from it, we come upon some black rocks of basaltic hornblende, the continuation of the dyke seen near the road. This basaltic hornblende almost in some of the specimens passes into basalt, and a large gneiss rock a few yards distant from this trap dyke has a basaltic dyke cutting through it—the strata of the gneiss about north-east and south-west, and the dyke north-west and south-east or more correctly N. N. W. and S. S. E. The basaltic dyke in length is about 78 paces—its greatest breadth about 2 feet, and the least about six inches—towards its smaller end a vein of basalt is seen running parallel with it.

We will now take a jump geological and transport the observer to the west end of the cantonment, placing him in a road which leads from the Infantry review ground to the pettah. This road is lined on each side

with trees, and must not be confounded with the military road, less than a quarter of a mile to the eastward of it, which also leads to the pettah. He will here observe another dyke running about east and west. It is seen first in the road, and protruding in rounded masses in the adjoining field; its dark appearance well contrasted with the grey of the granite through which it has burst—the soil resulting from the decomposition of the two is also well contrasted. The greatest breadth of this trap dyke is about 70 paces. On nearly a line with it and going westward, and across a large field, a confused group of granite rocks is seen with a large one of irregular shape perched on the top—one portion of it having been taken away for purposes of building. I mention this elevated portion as it forms a good guide in searching for a dyke of basalt close to it, in the same mass of rock, and only a few feet from it. By the mutual processes of quarrying and decomposition, only a very small portion of the dyke is here visible, and attached to the granite, but on looking to the west end of this group of rocks, distant about 30 yards, the continuation of the dyke is seen running east and west—in breadth two feet at its east end—about 30 paces in length and at its western extremity about two feet three inches in breadth. The granite rock it traverses has a smooth rounded outline, is compact and difficult to break, when broken into exhibiting numerous pinkish dots, the felspar in some places of a light flesh colour and some garnets distributed through it. I picked up a specimen of magnetic iron ore close along side, lying in the field. This basaltic dyke runs east and west and is on a line with, but distant about 27 miles from, the large and celebrated rock of Severndroog, seen rising majestically from the numerous smaller hills around it. Sivagunga lies more to the north-west, and is about the highest hill in Mysore. But to return to the dyke—about 15 paces to the south of it a smaller one is seen running in the same direction and through the same granite block, it is 5½ inches broad at its west end and three at the other, and about 15 paces in length, and deserves more the name of a vein than a dyke—in one place it has suffered displacement. On retracing our steps back to the elevated mass occupying the west end of this group, a small road is observed passing close to it, and leading to a very large gneiss rock in the direction of the pettah—crossing this small path is another dyke of basalt. It has undergone decomposition, and only a few pieces protrude; it is most likely connected with either of the two last described, from which it is distant about 30 yards. Several hundred yards further on in the same field, going west or a little to the north-west, close to a small valley across which a bund has been thrown, there is a

large gneiss rock much quarried, upon which a rude mud hut has been erected. Near this hut another basaltic dyke or vein is seen running about E. N. E. and W S. W. the strata of the gneiss about N. W. and S. E.; it is 57 paces in length, it seems to have entered from the westward, where its breadth is 8½ inches, takes rather a zigzag course, and at last becomes small and thread like, and is lost in the gneiss. In two places the basalt of the dyke has decomposed on its surface into a brick coloured looking substance.

Crossing the bund, and entering a spot where there is a good deal of cultivation and many trees, we arrive at a tank not of very great size, and not to be confounded with a very fine one near and close to the north-west gate of the pettah. As there is a peculiar arrangement of rocks close to the bund of this tank I will first describe them, before proceeding to the further account of the trap dykes. A large black mass, close to the end of the bund, is seen running down with a considerable slope, and is lost in the tank. At a distance it looks like a basaltic dyke, which I at first took it for, but it runs with the strata, does not cut across them, and is not basalt but hornblende slate. It is a large mass of hornblende slate, perfectly dyke-like in its appearance. The gneiss near it has a very slaty appearance, and contains very little mica, and next to it there are large masses of a very slaty rock of a grey colour, the strata perpendicular to the horizon—it appears to be a sort of argillaceous chlorite slate. Between this chlorite slate and the dyke-like hornblende slate, the gneiss rock, as just described, has undergone alteration, and assumed a slaty aspect. The observer now finds himself on a road which leads into the pettah; and about a hundred yards from the spot now described, there is a small tope of trees and apparently the continuation of the trap dyke which was seen about half a mile off bursting through granite—this dyke crosses the road, and is seen for miles stretching in a westerly direction, forming little elevations. If instead now of following the road which leads close to a very magnificent tank, and enters the pettah at its north-west angle, we turn off to the right and take the road round the pettah wall, some way on we find a road leading out of the pettah and taking a course about due west—this is the road to Severndroog formerly alluded to. There are some rocks to the south-west of this road, where the geological observer will find another basaltic dyke running about east and west—he also now finds himself in the very region of rocks, in the midst of which there is a very large village and several sawmy houses cut out in the rocks. In a direction further on again, he comes into the high road leading to Kingaree and Seringapatam, which I will now pursue, but

commencing at the gate going out of the pettah and near the fort.

A very short way after leaving this gate, a trap or greenstone dyke is seen close to the road on the left-hand side running for many miles to the westward—it here contains a good deal of felspar, and has numerous needle-shaped crystals of a white colour—this dyke cuts through granite containing very little mica, and is continued on for several miles. About two miles from the pettah gate, it is seen rising into two or three small hills on the left and close to the road. Here the trap assumes a basaltic appearance, and a regular dyke of basalt is observed passing through a granitic mass which lies between the trap rocks and the road, distant from the last about sixty-five paces. I here found a piece of micaceous iron ore. Some rather high granitic rocks are seen on the other side of the trap dyke, forming one end of a large bund which is worth inspecting, and which has been cut through—the masses of granite heaped together in a most confused manner. But resuming the trap dyke, which, as just observed, here forms two hillocks, it now passes to the other side of the Kingaree road, and extends as far as the eye can reach, forming slight elevations. On the other side of the road, and near it, there is a gneiss rock through which a vein of basalt passes, and from this rock a very extensive view is afforded. The trap dyke is seen on the left, near the road, and another is observed to the right, and they both run along for many miles. The one on the right of the gneiss rock is not so broad, but is in large tabular masses, not in rounded blocks, and approaches to regular basalt—a ravine between the two shows beds of pegmatite and of hornblende slate.

The region now under description is quite igneous, the specimens of trap varying in appearance, but more or less either regular basalt or basaltic trap. From this gneiss rock, the trap dyke, before described previous to coming upon the Severndroog road, is also seen. On returning to the main road, and passing through a small tope, the road continues along, leaving the first described trap dyke which stretches out to the west, the direction of the road being now about south-west. A quarter of a mile on, a basaltic dyke traverses the road east and west, the stratification of the rock through which it cuts being north and south—the breadth of this dyke about one foot, two inches. Continuing along this road for some way, a small stream is crossed, granite and gneiss rocks on each side—further on another small stream is passed, and now we find hornblende slate very common. Turning to the left, and following this stream on our way back, large masses of hornblende slate are exposed in the bed of the stream, and near this we come upon a rather high range of granite hills running north and south—the highest in the immediate neighbourhood of

the cantonment. To the south of the small stream, and near the granite hills, two conical and darker coloured hillocks are seen, consisting of chlorite, hornblende and actynolite—the specimens internally of a greyish green or blueish green hue. It is more compact than the generality of the chlorite rocks, and seems to be an intimate admixture of chlorite, hornblende and actynolite. Two miles nearer the cantonment, there is a conical hill, of the same appearance, but not so high, with several small hillocks running from it and taking a south-west course. The largest has a few shrubs growing from between the blocks, which lie in an irregular manner together, glistening in the sun—colour externally of a greyish or greyish blue, with very small holes or cavities, giving the specimens a somewhat variolated appearance. Some particularly in decomposition have a red, iron rust aspect; these contain much iron, internally of a greyish green with small cavities, containing oxide of iron, and when these are abundant it assumes in decomposition a reddish colour. It consists chiefly of chlorite and oxide of iron, and perhaps there is a little hornblende or actynolite. Following up the little hillocks which run from it, a good deal of quartz pebble is found covering the ground, and much magnetic iron ore distributed about, with large pebbly looking bodies, and pieces of what might be called iron stone, of a brown colour externally, black within from numerous crystals of iron ore, which, with some few small crystals of quartz, decompose into a species of iron clay of a brick red colour and quite indurated.

Chlorite rock is not uncommon in various parts of Mysore, and the hand specimens differ greatly even in the same locality, as in the immediate neighbourhood of the Mooty Tallao or Lake of Pearls, near the hill of Mailcottah, famous for its sanctity and its jewels. I have now before me a great variety of specimens many of them from between Madoor and Mundium where it abounds. One conical hill, upon which a pagoda is erected, on the right of the road, some few miles before reaching Mundium, is in appearance similar to the chlorite hills just described. I did not visit this hill, but the rocks on the road side, and on a level with it, are of chlorite with actynolite, a chlorite rock or slate either alone or with an admixture of hornblende and actynolite, as observed above, is not uncommon, and prevails between Mundium and Madoor, and in the neighbourhood of the Lake of Pearls. Besides the oxide of iron which it contains in nests, iron shot quartz is found and cubic crystals of brown iron stone. The specimens in my possession seem to answer to Dr. Macculloch's second subdivision, varieties. E. F. and G. Chlorite, talc, and potstone pass much into each other, and are arranged by Mr. Allan under the same head—talc comprehending the lighter varieties, and the last, when very coarse and indistinctly granular, forming potstone.

The geological enquirer labours under many disadvantages in India—the climate is constantly opposing him, and the condition of the inhabitants and state of civilization such, that few deep sections ever meet the view as in happier and less barbarous climes. The enquirer in other lands, has only to observe the stones used in building the houses of the inhabitants, from whence he may form some idea of the principal rocks in the neighbourhood; but in India, where mud takes the place of stone, this cannot be done, and we must be satisfied with the sections or nullahs naturally made, in the absence of artificial ones, and betake ourselves to these and to the large wells and tanks, the bunds and sides of which are constructed of stone. In his scientific investigations, the geologist is one, who daily realises the old classic adage, of truth being at the bottom of a well, that is, deep in the bowels of the earth. Of these nullahs three very large ones exist near the cantonment—one about 2 miles from Ulsoor on the north side of the Madras road—another close to the Infantry butts, and another about a quarter of a mile to the south of the Belfry. In many of these the decomposed masses of earth are of a beautiful pink colour, and have assumed a conical shape—I may describe a smaller one, which is distant about a mile and a half west from the Infantry butts, running about east and west, and terminating near a small village—it is somewhat different from the others, and I select it in consequence. At the upper or west end, beds of hornblende slate are exposed, then beds of mica or rather chlorite, sometimes the two running into each other, and decomposing into a yellowish green earth—a little way down the decomposing rock is almost a pegmatite, much red felspar with quartz, with a very slight coating or tinge of chlorite of a yellow green colour—the mica and hornblende are found again predominating, then further on the felspar and quartz—some masses close grained and passing into eurite. At the bottom of the nullah there is a village, as before mentioned, and much hornblende slate with veins of quartz running through it, giving the rocks much the appearance of flinty slate—pieces are lying about of a ferruginous dark appearance from the hyper-oxydation of the iron in the hornblende and quartz. Lying at the bottom of the nullah towards the top, there is also a species of soft chlorite slate. What is called the Belfry, is a small spot of elevated ground, upon which a pagoda, or rather tower, is erected, to the north of this nullah—it consists of lithomarge, and is said to be the highest spot of the table-land of Mysore. The elevation is one mass of lithomarge of a mottled red and white colour, which adheres strongly to the tongue and feels fine and greasy. This

hill of lithomarge confirms me in my views respecting the lithomargic formation, as entered into in other places. It has resulted from the decomposition of a rock or rocks containing hornblende and felspar—the white showing the felspar—the red the hornblende. Basalt has also most likely been contained in the rock originally, for besides pieces of felspar, of hornblende and of quartz, found lying on the surface of the hill, there were some of basalt. I also picked up one piece of magnetic iron ore. Upon the surface of this hill, or rather mound, are small nodules, of a brown colour and quite hard. On breaking into them they are of the colour of brick, with white specks diffused over them and irridescent blue iron spots and streaks; they resemble the pebbly looking bodies found in the chlorite rock along with iron stone. Now these indurated specimens seem to be those pieces of the rock before decomposition which contained much iron. By the kindness of my amiable and excellently informed friend Mr. McGrigor of the 39th regiment with whom, in geological brotherhood, I have visited all the places hitherto described, I am indebted for some specimens of a similar kind to the last, forming small elevations in the neighbourhood of and beyond Nundidroog. Surface irregular and of a reddish brown colour, internally brick red and resembling burnt brick, with lines, streaks and nests of decomposed felspar, as in the lithomarge just described, and spots and lines of a blue ferruginous colour. The soil in the neighbourhood of these hills is red and favourable to the growth of tobacco. These hills then seem to consist of a species of iron clay, intermediate between lithomarge and the laterite of the coast. From minute inspection of the rock, and in agreement with former views on the subject, I consider it entitled to the name of laterite, although it is scarcely cavernous. A study of these specimens, shows the passage of indurated lithomarge into clay stone or laterite. If the original trap rock from which it was produced, contained more felspar than hornblende, and not much iron, lithomarge is formed; but if the rock originally contained more hornblende than felspar and much iron, then the clay stone or laterite is formed. It is this last rock, I should imagine, which is described by Voysey, under the name of iron clay, forming elevated table-land at Beder.

Nundidroog, distant 35 miles north from Bangalore, rises in three majestic hills from the surrounding plain—at the distance it has the appearance of being only one hill, but there are three—one being thrown back some miles does not deserve to be included. It is said to be 1700 feet high. A peculiar kind of granite was brought me from here, but whether from the hill or not the person who brought it could not say—he thinks it was—he forgot to make a memorandum at

the time, and it was in the same bag with others. It looks an aggregate rock—large crystals of grey quartz in a confused mass of felspar of white colour, with only a very few of the very smallest scales of mica, scarcely perceptible. To the west of Bangalore, some most picturesque and beautiful hills are seen running in a direction about north and south. They are of various sizes and show a variety of shape—some of the smaller, peaked, but the greater number having a somewhat cupola or dome shape, mentioned as peculiar to porphyritic granite, which they are. In the midst of this range a large rounded mountain is conspicuous above them all, Severndroog, once famed for its strength as a hill fort, and now still famous for its unhealthiness. The country in the neighbourhood is of a wild and wooded character, which first commences about 3 or 4 miles beyond Tauverkairy, 13 miles from Bangalore. This range of hills is between 20 and 30 miles from the cantonment. About 4 miles beyond Tauverkairy passes the Arkawutty river, the largest in this part of Mysore. In its bed are some beautiful specimens of granite, with red and green felspar, and the mica in decomposition, giving a greenish tinge to the rock. The road after crossing the river ascends, and there is a pass through the hills and rocks which are elevated above the surrounding jungle. The rocks are of granite, showing more or less the porphyritic character—the felspar both red and white. I possess some beautiful specimens which I found lying about, consisting of green felspar with blueish quartz and crystals of red felspar distributed over them, some of the specimens are of red felspar with a chlorite tinge in some places—other specimens again are entirely of green felspar.

Severndroog and the surrounding hills are of porphyritic granite—more marked in some than in others—the felspar red and the mica greenish black. Much trap is seen lying about the road in small pieces, and it is very conspicuous in the rocky hills, giving them a dark appearance in certain places. I have never proceeded further in this direction, but my friend Mr. McGrigor sent me some specimens which he picked up between Coongul and Belloor, apparently a very interesting tract of country: the specimens are trap, of which many of the hills seem to consist—flinty slate, talc slate, actynolite, and chlorite slates, and a species of chlorite porphyry, the felspar red. This is the main road to Semooga, the present capital of Nuggur or Bednore. At Chineroypatam is the famous statue cut out of the solid rock, and near Belloor are the ruins of Hallibede, both of which are well worthy of inspection. Not far from here, are the Baba-Booden hills, giving origin to the Badra river, which uniting with the Tungha near Semooga, forms the Toombuddra. By the kindness of two very zealous and talented botanists,

Lieut. Munro and Mr. Gough, I have been favoured with some specimens of which they say the Baba-Booden hills principally consist. Flinty slate and quartz rock seem common, and are much impregnated with iron. One specimen of flinty slate, or perhaps what Buchanan would call hornstone, affects the magnet, and another is full of particles of iron sand, granular magnetic iron ore. I possess two kinds of the magnetic iron—one an amorphous mass, of a reddish blue colour, highly magnetic, and possessing polarity in a very great degree—in fact the natural magnet or loadstone, apparently the same as found in Siberia and the Hartz. The other specimen or specimens are slaty, tabular slaty masses, externally of a brownish yellow tinge and internally of a dark purple colour. This slaty kind is also highly magnetic, and exhibits polarity in a very high degree. Besides these, there is hæmatitic iron ore, and its passage into a rock which somewhat resembles laterite. An argillaceous potstone seems also to be common; it is of a yellowish brown colour, very soft and greasy, and is I imagine the talcose argellite of Buchanan, some specimens more argillaceous than talcose, and others more talcose than argillaceous.

Another kind of stone I possess of a dark colour externally, but internally of an olive green black, very soft and rather greasy—it is used for manufacturing gods out of. I have not seen it in any other part of Mysore, it may be called a talcose hornblende, being a mixture of either talc or perhaps potstone with hornblende. In the specimen described, the talc predominates over the hornblende, but in some, found between Mysore and Nungengode, the hornblende predominates over the talc and is of a green colour. I am not aware that this rock enters into the formation of the Baba-Boodens, but it is found in the neighbourhood.

The rocks then forming these hills are flinty slate, quartz rock, both much impregnated with iron, the granular magnetic iron ore. Hæmatitic iron ore, slaty magnetic iron ore, and the same in amorphous masses, and argillaceous potstone.

The whole of the Nuggur or Bednore district of Mysore abounds with iron, which I am told fetches a very high price in the Bombay market. At Hurryhur, distant from Bangalore 185 miles, and according to Heyne 1831 feet above the level of Madras, and probably the lowest point in the whole of Mysore, Buchanan tells us the basis of the country is somewhat between an argellite and schistose hornblende, and between the strata of this argillaceous hornblende slate are masses of an earthy quartz or hornstone impregnated with hornblende.

I will now describe some portion of the south-west part of Mysore,

proceeding to the bottom of the Neilgherries, and then turn off at Mysore in the direction of Coorg. The Kingaree road has in some measure been before described, granite and gneiss rocks, with several trap dykes, and much basalt and basaltic trap. About half way hornblende slate in large beds is very abundant, and the country very bleak, and only very slightly cultivated—soil stony and unproductive. Between Biddidy and Closepett the country is wooded, very little cultivation and much pasture land; as we approach the last mentioned place the masses of rock near the roadside are of porphyritic granite, the felspar of a light flesh colour. Closepett, or Ramgiri in the native dialect, has a most picturesque locality in a valley close to the Arkawutty river, enclosed on two sides by hills of considerable height. There is much dense jungle around, and the rocky hills, shaped like Martello towers or bastions, rise up from amidst the jungle. The porphyritic character of the rock is here better marked than in the Severndroog direction, for these belong to the same range. The country immediately on the other side of Closepett is still wooded, but the hills are of much less elevation, and have lost the porphyritic character. To the north of the road there is gneiss, full of garnets of various sizes, strata of the rock running about north and south; and on the road, and bordering it, are detached specimens of a heavy ferruginous looking stone, consisting seemingly of quartz and hornblende.

About half way towards Chinepatam, there is a temple dedicated to Hanuman, the very wonderful monkey god, who with chivalry for distressed damsels perfectly quixotic, led an army over to Ceylon, and delivered from thraldom a beautiful princess. Near this temple are some red rocks, looking at the distance like ant hills. This is the red granite of Buchanan, and has before been described—it chiefly consists of red felspar of a very clayey aspect. A little way beyond this the hills recede, the country opens, and a flat cultivated plain extends on the right, some jungly hills still on the left. The principal rock around Chinepatam is gneiss, but different from the rock round Bangalore, here it is red instead of grey. Around Bangalore the quantity of black mica, with the white felspar and quartz, gives the rock a grey appearance, but here the specimens are beautiful from the quantity of red felspar in patches, veins and streaks. The country continues open, much wet cultivated ground for some miles, succeeded by open plains covered with small bushes, chiefly the *cassia auriculata*, which is very common and used for tanning—very few stones or rocks on or near the road, and those containing red felspar with small garnets. Further on the road becomes very sandy, the soil showing a saline impregnation, and topes of toddy trees cover the country. In the river Madoor, which, as usual with most

of its class in India, contains more sand than water, gneiss is exposed, and many of the pebbles of quartz picked up are of a green colour from chlorite—water-worn pieces of kunkar, like finger coral, are also mixed up with the sand.

Madoor is close to this river, and is a small and as usual dirty village, with much cultivation in the neighbourhood. On leaving Madoor there are some hornblende rocks on the right and close to the road—hills now at considerable distance—ground in long swells, and covered with stones and long grass—pieces of quartz and hornblende on the road, very few rocks. Hornblende slate in various places is seen passing across the road, with much iron sand in the nullahs. About four miles before reaching Mundium, and previous to descending into a very extensive valley, containing much black soil, a small conical shaped hill, with a pagoda on it, is seen on the right-hand side of the road, but distant. It has the same form as the chlorite hills near Bangalore; on the road chlorite slate is picked up in several places, and just on entering the valley there are several rocks of chlorite and actynolite—brown exterior, internal surface decomposing and ferruginous. These specimens vary much, some are altogether of chlorite, others of chlorite and actynolite, the needle-shaped crystals of the last very distinct, and some are very hard and close grained—an argillaceous chlorite. In one place the rock was porphyritic, the basis chlorite with crystals of white felspar imbedded. This valley contains much black soil, with kunkar, and on the Mundium side a stream runs along which has exposed the rock viz. gneiss with large beds of hornblende slate—the felspar in this gneiss of a snow white colour, with silver mica. Near the bungalow at Mundium, outside the wall, are several rocks of hornblende, and on the other side of the large tank salt is manufactured, but of a very impure kind. It is obtained from the soil which in several places betwixt Mundium and Madoor is full of it, and in which the palm flourishes.

Two or three miles from Mundium on the Seringapatam side, the soil is calcareous and clayey. Small pieces of kunkar, like marbles lying about—the ground low and as if once much under water—some hills of slight elevation, running parallel with the road on the left-hand side, and most likely consisting of chlorite slate and actynolite slate, as some specimens were found forming a water-course which passed over the road, along with a porphyritic rock, met with, and to be described, in the bed of the Cauveri near the Wellesly bridge at Seringapatam. In a deep nullah near the road a little way beyond this spot, gneiss rock exposed; felspar red, with beds of hornblende slate, and veins of a calcareous substance resembling kunkar—kunkar in a valley below. Towards Seringa-

patam the country becomes more elevated and barren, much quartz covering the road. Sometimes quartz rock jutting out of the ground, but principally hornblende slate—the road then passes through a range of low hills terminating in the Corighaut hill.

This range of low hills, better seen coming from than going to Seringapatam, is of smooth outline—no deep valleys between—one hill running into another, peaked slightly at top, and sloping down, meeting another of the same formation, and well contrasted with the porphyritic granite of the French Rocks at the distance. These hills of low and smooth outline, and through which the high road passes, are of chlorite slate—the chlorite of a beautiful light green colour and glistening—much quartz in small pieces lying about, and the gneiss rock showing the passage into mica slate. In one spot on the road, the union existing between hornblende, actynolite, tremolite, and asbestos, was well shown, as mentioned by mineralogists, and it would have been difficult to define well and clearly which they decidedly belonged to. Here also there are some rocks of the red stone before mentioned, containing principally a red clayey felspar, with small microscopic cavities of a black shining metallic substance. This region is altogether a very marked and slaty one—the country rather elevated, and very bleak, and with not the least cultivation. As we approach Seringapatam, trap dykes are observed on both sides of the road.

Seringapatam, a place of such classic military celebrity, lies low, and in a valley, high ground on three sides of it. It is built upon an island, formed by the branching of the river Cauveri, 2,412 feet above the level of the sea, and therefore between five and six hundred feet lower than Bangalore. It is a place possessing much interest both to the military and medical man. The eye of the last wanders over it, questioning the reason of its unhealthy celebrity. Many writers, and the very best, Mr. Geddes, are inclined to refer its unhealthiness to its proximity to a jungly tract of country, not entirely overlooking its site, but perhaps not allowing sufficiently for it. If proximity to jungle had any thing to do with it, the French Rocks, distant only six miles, would be similarly unhealthy, which they never have been. It is as healthy a station as Bangalore or any other in the Mysore country. In 1835, the 19th regiment N. I. lost only 5 men—in 1836, 11 men, and in 1837, 18 men—average for the 3 years 11. In all investigations into the sources in general of disease, we are too prone perhaps to attach importance to one particular cause, neglecting the combined influence of minor circumstances—and where one does not stand out prominent, we throw the others aside as perfectly insufficient. No jungles being close at hand, no extensive marshes in the neighbourhood,

the bed of the river being rocky and not muddy, none of the very marked features of miasma present, we dismiss the subject as incapable of explanation.

But allow me to describe Seringapatam particularly as it must have been some years ago, and the description is one that all must confess to be unhealthy—a small island, lying very low, containing a dense and dirty population, enclosed by the high walls of a fort. On looking down from one of the minarets near the gate opposite the Durria Adaulet Baug, we observe, that the fort must have been at one time crowded with houses to the very fort walls, affording a density of population seldom I should imagine equalled. Even now we observe the streets or lanes are extremely narrow, and the collection of filth very great. But density of population and filth cannot alone account for the disease, for many have contracted the fever and died in the Durria Adaulet Baug and Laul Baug. The first still exists, and is considered the public bungalow, a native palace in the centre of a fine park, one of the branches of the river passing near it. Is it here, then, lowness of position alone which is prejudicial? I believe not, and suspect miasma is combined with it. If asked what miasma is, I must borrow a word from an excellent writer, Dr. Fergusson, and say, *nescio.*

I do however believe that we may expect some light to be thrown on the subject by geology. This science has already explained some points connected with disease; the existence, for instance, of goitre in those districts in mountain tracts where limestone is the principal rock; and its not attacking even neighbouring villages, if built on granite, the water of course being calcareous in one, and not in the other. The island and immediate neighbourhood of Seringapatam show, that igneous action has been much in operation. I mentioned above that trap dykes were seen just before entering, and over the northern branch of the river a bridge is thrown, close to which there is an arrangement of rocks worthy of notice—a red looking mass, dyke-like, runs across the river, and is observed to be porphyritic—the basis a red felspar with imbedded crystals of white and reddish felspar, and innumerable needle-shaped crystals of schorl, or perhaps what might be called schorlaceous actynolite—some parts of the rock having a coating of a green substance, chlorite or actynolite. It is a beautiful looking rock, and well contrasted with gneiss, which is along side of it. This gneiss distinctly stratified, and containing much black mica. Along side of this and nearer the bridge, there is a large mass of hornstone running, dyke-like, in the same direction. Hornstone, which is common over the island, is of two shades or colours, one grey and the other blue; the grey kind is

full of elegant moss-like impressions, most likely oxide of manganese; the blue kind does not seem to possess them, but both contain imbedded small crystals of glassy quartz. On the other side of the bridge, the bed of the river is very rocky, and the rock exposed is a gneiss with much red felspar, black or blueish black mica, white quartz, and veins and patches of a light green substance, actynolite. Near this last and forming the bank of the river is a large quantity of kunkar, having a decomposed water-worn and almost osseous appearance. The surface rock on the island is hornblende, and in one place, opposite the Bangalore gate, leading to the public bungalow, it is hornstone, in large tabular masses. From observing the quantity of hornstone in the walls of the fort, I am led to imagine that it must have once prevailed much. The ditch shows gneiss rock decomposing, with beds or dyke-like masses of hornstone traversing it—some of these having a vertical, others an horizontal, position. There are also numerous trap dykes. From trap being the common surface rock, with hornstone and the red porphyry above described, we may I think call the locality an igneous one. It is perhaps needless here to mention, that igneous, or rather volcanic, countries like Italy, &c. &c. &c. are highly miasmatous. There is one point it is necessary to touch on, connected with the subject of the geology of the neighbourhood, I mean the soil. To the east and south-east of the fort there is much cultivation. I observed the sugar-cane in particular, and I may in passing just remark the general unhealthiness of those West India Islands where the sugar-cane is cultivated to a great extent. The soil in this direction is of a black colour, which I have no doubt arises from the constant state of cultivation it is kept in, and from the quantity of water obtained so easily from the neighbouring river. Where there is much cultivation, and where much water is mixed up with a soil, that soil is generally of a black colour. This water it must be borne in mind passes through an immense tract of jungly country, and must contain a very large proportion of vegetable matter. There is another point also. The bed of the Cauveri is full of large rocks which have a clean and healthy look, at least what would not be imagined miasmatous; but may not these large rocky masses with pools of water about them generate miasma? May they not absorb the water and extricate a gaseous and miasmatous principle from the rents and cracks produced by the sun's rays upon them? The granite statue of Memnon is well known to have emitted sounds when the morning beams darted upon it, and M. Humboldt, the greatest authority as a scientific traveller, mentions that from some of the granite rocks of the Orinoco subterranean sounds have been heard, resembling those of an organ, and

supposes them to be produced by the passage of rarified air through the fissures; and he seems to think that the impulse against the elastic scales of mica which intercept the crevices may contribute to modify their expression. The epidemic fevers which prevail on the Orinoco, the natives refer to the noxious exhalations that arise from the *bare rocks* of the rapids. This Humboldt remarks is worthy of attention, on account of its being connected with a fact that has been observed in several parts of the world, although not sufficiently explained. Among the cataracts and falls of the Orinoco, the granite rocks, whenever they are periodically submerged, become smooth and seem as if covered with black-lead. The same appearance is presented at the cataracts of Syene, as well as those of the Congo. This black deposit, according to Mr. Children's analysis, consists of oxide of iron and manganese (so says Mr. Macgillivray, the translator of Humboldt), to which some experiments of Humboldt induced him to add carbon and super-carburetted iron. Mr. Macgillivray goes on to say that this phenomenon has only been observed in the torrid zone in rivers that overflow periodically, and are bounded by primitive rocks. M. Humboldt supposes it to arise from the precipitation of substances chemically dissolved in the water, and not from an efflorescence of matters contained in the rocks themselves. The Cauveri overflows periodically, and its waters pass through a most jungly tract of country.

There is another circumstance connected with the river, which is this—that although there is often but little water, thus leaving bare the rocky masses, water will most likely be near the surface of the ground all over the island, and lead to dampness and exhalation. In the mornings and early part of the forenoon, a dense vapour covers the fort and island, when the neighbouring country is perfectly clear. All valleys and low positions in Mysore, are more or less unhealthy, and are much hotter in the day and colder at nights. The mean annual temperature of Seringapatam is two degrees higher than Bangalore—the average mean lowest of Seringapatam about 63—that of Bangalore 69—the average highest of Seringapatam 90—that of Bangalore 81—a difference of 27 degrees in the one, and only 12 in the other. This alone might account for the prevalence of the fever, and the other circumstances, previously mentioned, explain its malignity.

The rocks between Seringapatam and Mysore are chiefly igneous, trap and porphyry—hornblende seems the most common, and has often on the surface a most variolated aspect. There are few rocks besides the hornblende, not including the usual granite and gneiss, to be met with, but many of the buildings on the road side consist of a rock of a porphyritic character, purple brown compact felspar, with white or reddish

crystals of felspar imbedded, and numerous small pieces of schorl, not so much in needle-shaped crystals, as in dots. Hornstone porphyry appears also to be common and some of the specimens very beautiful. One in particular with crystals of red felspar in a basis of dark coloured hornstone—another kind which formed a dyke running east and west, contained very minute round or oval crystals of felspar, like the eggs of some insects, with needle-shaped crystals of schorl. I found another kind to the left of the road, the hornstone of a dark colour, the felspar crystals chiefly white, with schorl and iron pyrites. Just before entering Mysore there is much hornblende rock, giving a ringing sound under the hammer.

Between Mysore and Seringapatam there are few or no tanks, the country watered by a fine canal, which twists and turns in all directions, and is crossed six or seven times between the two places. Mysore itself lies low, under a very high hill of the same name, a thousand feet above the plain. The country around is slightly elevated; a fine red soil prevails, in some places highly cultivated. A deep section called Purneah's cut, close to the town, enables us to see the formation—the rock is gneiss, in a decomposing state, with veins of quartz and beds of hornblende slate, the mica is of a dark green colour. The gneiss rock here differs from that of Bangalore and Chinepatam, by containing much green mica, and the felspar is both red and white. This cut, according to Hamilton, is thirty miles in length, between thirty and forty feet in breadth, and sunk in some places to the depth of eighty feet through strata of solid rock. Purneah appears to have been a truly clever and public spirited man. The Government ought to erect a monument to his memory, and place it in the very centre of the town, to show how much it appreciates native talent, energy and public zeal, and as an incitement to others of his countrymen.

The stones in the fort of Mysore, within which is the palace of the raja, and those used in constructing the neighbouring fort of Mungerabad, which was commenced by Tippoo, show specimens of the rocks around. The most common is the gneiss just described, white and red felspar, very little quartz, and much green mica in stripes—then there is a rock of red felspar and glassy quartz, felspar predominating, and in large crystals, with only a few scales of mica—red compact felspar with veins of actynolite, and then a sort of porphyritic or augitic hornblende rock. Mysore hill consists of common and porphyritic granite—the felspar is abundant and is either white or with a very slight tinge of red, very light flesh colour—mica blueish and black. The porphyritic character of the rock is best seen from the road leading to Nungengode; the stones on the road used for building show it. The rock at the bottom

of the hill, near what is called the zigzag, is of chlorite and actynolite slate. The rock on the Nungengode side as shown in a large nullah near the road side, opposite the Delwahairy tank, is chlorite, or perhaps more correctly a talcose chlorite slate, with actynolite, and perhaps tremolite. Chlorite, talc, actynolite and hornblende are constantly running into each other, and the specimens are often difficult to define. In nature there are not always those decided specimens which are arranged and described in cabinets—order exists more in the mineralogist's head, than in nature—nature indeed is often very disorderly, but by systems and classifications we endeavour to tie her down.

On the road to Nungengode a chlorite slate, combined perhaps with hornblende, is seen near the above large tank, and is decomposing into a red soil It is of a red colour externally—further on, I picked up specimens where the hornblende predominated over the chlorite, or talcose chlorite—on the road side specimens of magnetic iron ore, with also some of micaceous iron ore. The private bungalow and park of Nungengode, the prettiest spot I have seen in India—the house, in the cottage style, placed on the borders of a fine river, and in a large compound deserving the name of a park, in which are the finest tamarind trees I have ever beheld. Proceeding towards the bridge, by the little path near the water side, we find a ledge of quartz rock impregnated with chlorite, and further on, granite or gneiss, close grained, with very minute specks of black mica—near the bridge much hornblende slate—in one ledge of it, a few garnets—hornblende slate continues on towards Mysore, with much chlorite or talcose chlorite on the road. In the sandy bed of the river, are pieces of kunkar, of a water-worn appearance, of a very light consistence, and like pumice.

Nungengode is a large town, *famous* or rather *infamous* for its pagoda, on which are carved figures of the most indecent character. It was here, where two hundred Jungum priests were murdered. They were called upon to attend the raja, quite unaware of their impending fate, and, on admittance to his presence, whilst bending their heads in token of submission and respect, had them severed from their bodies. Sindhully, a public bungalow about five miles further on, is built on elevated ground—few rocks around—the country covered with long coarse grass—the soil of a very light red—pieces of hornblende and quartz on the ground. One or two decomposing granite and gneiss rocks, and a section near the bungalow, from which water is obtained, shows hornblende slate, the decomposition of which I should imagine gives the colour to the neighbouring fields. On the Goondlepett side of Nungengode are

many topes of toddy trees—much kunkarious soil, with saline impregnation.

The road to Goondlepett is extremely wide, with magnificent trees, of apparently great antiquity, on each side. The country is flat, but not very much cultivated, has the appearance of having been once much under cultivation. On the road ancient kunkar, in rounded masses jutting out of the ground, and blocks of the same kind forming the bunds of some of the tanks. It is almost a calcareous conglomerate, pieces of quartz, actynolite and hornblende mixed with it, and answers to that described by Colonel Cullen as found at Cuddapah. Goondlepett, a place which some years since was almost depopulated by a visitation of cholera, is situated on an extensive plain ; large nodules of kunkar jutting out of the ground, with small pieces lying about—around the fort and in the ditch much actynolite slate, and much kunkar attached to and connected with it. The stones in the walls of the fort consist chiefly of hornblende slate. There is a very pretty rock of red felspar with actynolite, and another a sort of chloritic porphyry. I found a specimen or two of calcareous spar, or perhaps slate spar. The country towards the Neilgherries, which are only distant about 35 miles, is very flat—the calcareous conglomerate showing itself on the road side, gneiss in a decomposing state, with beds of hornblende slate and pegmatite—much quartz hornblende slate and kunkar lying on the road. About 4 miles from Goondlepett, the jungly tract is entered, which surrounds the bottom of the Neilgherries and renders their approach so dangerous.

Before reaching the Tippicado river, there is mica slate in one spot on the road, and the granite, or rather gneiss, assumes a tabular shape and slaty appearance, containing much blueish black mica, a tinge of red in the rock. In the Tippicado river, and around, there is much hornblende slate in large tabular masses, like tombstones, fixed in the earth, and inclining a good deal. The road then winds round these immense mountains, the trees larger, but the jungle not apparently very dense. The Segoor Pass, leading up to the Neilgherries, is the shortest, and, under the scientific superintendence of the engineer officers, the best constructed, of all the ghauts.

The deep sections in this ghaut show hornblende rock and sienitic granite. Towards the top, a little way above what was the Sapper encampment, basalt of a black colour is seen passing into the sienitic granite, and the passage from hornblende rock to basalt distinctly seen. In the sections made in forming the road, the sienitic granite and hornblende rock are found in nodules, decomposing in concentric laminæ, like the layers of an onion. There appears to be more felspar

in the rocks in this ghaut, than any of the others, and masses of it decomposing give a chalky appearance to some parts of the road. Some way down there are beds of compact felspar, through which a green basalt has burst, and mixed itself up with, and the hornblende in the rock then becomes of a green colour, being generally black all over the hills. About Adams Peak, 4½ miles down the ghaut, garnets appear in the rock in nests, and afterwards abound in it. The bottom of the pass is about 400 feet higher than Bangalore. As the Neilgherries are not a part of Mysore, it would be out of place my describing them here, a task so ably and minutely executed by Dr. Benza.

In describing another part of Mysore, I will take a fresh departure from its capital, and proceed in the direction of Coorg. At Yelwall, distant about 9 or 10 miles, the country is elevated and rather bleak, much high coarse grass covering the ground; cultivation in the valleys. In the compound attached to the Residency, there is a good deal of chromate of iron, which was found I believe by Captain Haldane, the officer commanding the Resident's escort; it is lying in pieces on the ground, and near it a rock of hornblende slate of a green colour, which as it has a tinge of yellow externally on its decomposing surface, most likely contains a little of the chromate. At the bottom of the Residency, but outside the wall, there is a nullah, where mica or chlorite slate is exposed. The sand in the nullah abounds with garnets, some of considerable size. Kunkar is also found at Yelwall, some feet below ground, in lumps or nodules of a brownish colour, and irregular, almost pisiform, surface; the soil is inclined to black where it is found, and pieces of hornblende slate cover the ground. There is magnesite also I am informed in the neighbourhood. The road between Yelwall and Hoonsoor is through low jungle, or what in some places would with more propriety be called brushwood; quite a trap region, some specimens of the trap porphyritic, forming a greenstone or hornblende porphyry, crystals of felspar imbedded.

Towards Hoonsoor, much magnetic iron ore on the road. Near this place the country is more jungly, and Hoonsoor itself lies rather low, rising ground on all sides, hilly to the south and west, some of the hills covered with low jungle, the soil both black and red. The locality is a very interesting one, and the mineralogical features were pointed out to me by Mr. Gilchrist. Besides granite, gneiss and trap, of which there are several dykes; the granite and trap decomposing in concentric laminæ, like the basalt *en bouille* of the French, or nodular basalt of Voysey; there is in some places a good deal of a brown and rather compact but not crystaline limestone, or rather ancient kunkar, which instead of being united, as at Goondlepett, with hornblende,

actynolite, quartz and other minerals, forming either a conglomerate or breccia, is found connected with semi-opal, ferruginous opal, or jasper opal. The soil where it is found is black, well contrasted with some high ground near it, which is red, and most likely ferruginous and not calcareous. Much magnetic iron ore on the surface in some places, and sometimes attached to the semi-opal. In a most interesting spot, pointed out to me by Mr. Gilchrist, a low, ragged, and peculiar looking rock, juts out only a foot or so from the ground; it is of a brown shining aspect externally, and I think deserves the name of jasper opal or ferruginous opal, and passes into semi-opal, chalcedony and a coarse kind of jasper. Near this there is found a chloritic talc slate, which graduates into a sort of potstone. The jungly hills to the westward are of granite towards the top, with trap at the bottom; magnesite is found in the neighbourhood.

The road towards Periapatam is for some miles jungly, and then is very flat—much kunkar in small nodules on the surface, trap dykes passing across the road, chiefly of hornblende with crystals of olivine. In several places, found jasper opal, as at Hoonsoor. In a ditch near Periapatam decomposing gneiss, with vertical veins of a tufaceous limestone, and above the gneiss, large masses of nodular basalt, decomposing into a yellow earth with black soil on the surface. In the ditch or nullah, were large masses of basaltic hornblende, ringing on being struck, with a peculiar squeezed appearance, like half wrought images. I have observed this frequently in the basaltic hornblende—is it the result of igneous action under great pressure? A very flat country around Periapatam, with much water and much kunkar in the soil. The country, all the way to Fraserpett or Cushelnugger, is jungly and hilly, with small villages and patches of cultivation here and there. Soil generally black—all the hills appear to be of trap—in one place where a section was afforded, the soil on the surface was black, but reddish below. Near a village about half way, found specimens of a very coarse jasper opal, approaching upon and running into quartz; and a white calcareous like substance, with hornblende slate, decomposing in horizontal strata.

The Coorg mountains are part of the Western Ghauts, and consist of horn blende rock and sienitic granite. The geological formation resembles much that on the Neilgherries—only the hills are smaller, more generally rounded, and show a more perfect state of decomposition into lithomargic earth. Quartz veins and iron ores are not abundant, indeed of the last I saw none; and nothing answering to Benza's hæmatitic iron ore; but it is

very extraordinary how few rocks elevate themselves above the ground. We may wander over one hill and then another for miles, and not meet with a single rock. Decomposition has taken place to a great extent as shown where sections have been made in forming the roads. In some of the deep sections near Mercara much porcelain earth is found in beds in the lithomargic earth, and some of a decomposed earth answering to the shidi munnu in the neighbourhood of Bangalore. In a deep pit about two and a half miles from Mercara, a thick bed of laterite was pointed out to me by my most intelligent friend Dr. Baikie. On the top of some of the hills I found granite or rather pegmatite, and the valleys below of a whiter colour than usual. The hills at Coorg are smaller and more irregularly grouped together, with numerous narrow valleys intervening, many of them so narrow, that the inhabitants cut away a little of the lower portion of some of the hills, in order to cultivate; being able in this way to irrigate. All the valleys I saw contained a light yellow soil, and from this and an inspection of some few of the rocks which occasionally have resisted decomposition, I imagine felspar is the most abundant mineral, which with hornblende has formed the lithomargic earth. On the Neilgherries, the surface of the soil in the valleys is black, with a yellow clay beneath—here the soil in the valleys and generally on the hills is light yellow. There is another great difference in the vegetation. On the Neilgherries many of the hills are bare, or have only trees at their bottom or running up a portion of their sides; whereas at Coorg, most of the hills are covered to their very summits with a variety of trees of the most beautiful kind. The immense quantity of rain which falls (the quantity from June 1835 to May 1836 being 119.14 and from June 1836 to May 1837 87.04—for this information I am indebted to Dr. Baikie), must encourage vegetation, and the decomposition of rock.

According to Dr. Baikie the temperature is most equable, the daily range inside never exceeding 6° or 8°, often not beyond 2°. Thermometer seldom above 74, or below 60. The maximum of barometer occurs during the dry season, the highest noted being 26.220—and the lowest in July during the monsoon 25.912—the greatest daily range observed was .076 the mean .050. Mercara is 4506 feet above the level of the sea, and its mean temperature is perhaps about 68. Ootacamund is 7361 feet, its mean temperature 58.68. Bangalore nearly 3,000 feet, mean temperature about 75. The Western Ghauts consist of hornblende rock, with garnets and sienitic granite—mica is not absent—a micaceous rock with much foliated mica I found at the very top of the Heggula ghaut. Mysore is surrounded on three sides, south, east and west, by the wes-

tern and eastern ghauts, the Neilgherries uniting the two—the passes leading down into Malabar and Canara being very grand.

Iron is generally obtained in Mysore from the iron sand, very abundant in some parts of the country, and washed down into the nullahs. On the Baba Booden hills it is obtained from the magnetic and hæmatitic iron ores. Buchanan mentions its being obtained from two ores at Ghettipura, a village about 7 miles from Maurgree. From his description of the *Aduru Cullu,* it appears to be a quartz much impregnated with iron, the hard specimens called the male stones, and those in a decomposing state, the female. The other ore, mentioned by him under the name of *ipanada,* I imagine to be the magnetic iron ore, pure without any admixture of quartz; for this is found occasionally in the fields and on the roads all over Mysore. In most of the rocks around Bangalore and on the roads, pieces of a very ferruginous looking character are seen. They have the appearance of iron, but are quite light, and do not affect the magnetic needle, but when ground into dust, are attracted strongly by the magnet. I was long unable to define them, but I now think they are specimens of what Dr. Heyne calls ferrilite, a species of hornblende, and from this ferrilite much iron must be derived.

Antimony—one or two specimens of this were brought me by a native from or near the Baba-Boodens. He says it is abundant there, and if so, it is an important discovery, for Dr. Ainslie mentions that this mineral has not hitherto been found in our Indian dominions.

Gold and *silver* have both been found in Mysore. From what I observed at Manantoddy and in the Wynaud jungle, in a direction towards the Neilgherries, I have no doubt gold exists in considerable quantity in this most unhealthy district. At Mullialum, not far from the bottom of the Neilgherries, a species, or rather sub-species, of raja rents from Government the golden region. Mullialum is not in Mysore, but on the borders of it. The golden region is about a mile and a half from the village, and opposite it. A very high mountain is seen rising above the others, shaped somewhat at the top like the head of a violincello. In front of it are a smaller range of hills, and it is on the sides of these where pits are dug, and the yellow or red soil removed and washed for gold. Near these pits, and carried round the small hills, are artificial water-courses, and the soil is taken from the pits in baskets and washed there. In the excavations, along with a very rich yellow soil, are stones of quartz. The surface of the ground is covered with long coarse grass, below which there is about 2 or 3 feet of a red earth, full of pieces of quartz, and below a rich clayey reddish yellow earth. A quartz rock is the prevailing one in the Wynaud, as far as I could observe, and in many

places as at Mellialum is auriferous—it is from the decomposition of this into soil that the gold is procured. Gold was discovered in the eastern provinces of Mysore by Lieutenant Warren of H. M. 33d regiment in 1802—he found it in the small nullahs, or ruts, or breaks, in the ground, at Warrigum, a small village 4½ miles S. W. of Battamungalum—also on the banks of the Palar river, and the Ponian, near Caargory—from a load of this earth near the last, he obtained three sparkles of gold. He found gold also at Marcoopium 3 miles south of Warrigum—here there were mines worked by the natives. Tippoo had worked them also, but desisted on finding that the produce just balanced the expences. The strata described by Lieutenant Warren as existing in the different mines do not agree, but the ore was found in large stones, of a siliceous or quartzy nature, of a black changing to deep rust colour, to which generally adhered a deep orange soft substance. Within the golden tract the proportion generally obtained by him was *one* grain of native gold out of 12 baskets of earth taken at random.

Corundum is found at Mundium near Seringapatam, and in other parts of Mysore, as at Tippity Beygoor, three days march from Bangalore, and Bunercottah, about 12 miles from Beygoor, 9 miles from Bangalore—it is of different colours grey, blue and reddish. Rubies of a coarse kind have been brought me; and also *beryl*, or what Dr. Heyne calls the schorlous beryl.

V.—*Remarks on Cambogia Gutta Linn.—Stalagmitis Gambogioides Murray; and on Laurus Cassia Linn.—By* Robert Wight, M. D.

Two subjects of botanical inquiry, both of considerable interest, have recently engaged my attention; and as the conclusions at which I have arrived are somewhat different from what I anticipated at the out-set, I think a summary of the results may not be uninteresting to your botanical readers. The first of these, taking them up in chronological order, was the examination, for my Illustrations of Indian Botany, of the natural order Guttiferæ for the purpose of marking out its limits and elucidating its Indian genera and species. The second was an endeavour to ascertain the *Laurus Cassia* of Linnæus, and the tree which furnishes the Cassia bark, or *Cassia lignea*, of commerce; undertaken by order of Government, with a view to the solution of a question submitted for its

consideration by the Ceylon Government. Adopting the same course on this occasion, I shall commence my present remarks with the Guttiferæ.

In the 13th number of the Madras Journal of Science I published some observations on the genera of this order, elicited by a communication of Dr. Graham respecting the Gamboge plant of Ceylon. In that paper I showed that the genera *Garcinia* and *Cambogia* of Linnæus were the same, and that *Stalagmitis* of Murray was, so far as could be ascertained from characters only, identical with Roxburgh's *Xanthochymus.* Conceiving the genus *Garcinia* too complex I there proposed subdividing it. The following extract will explain the views I then entertained.

" In my opinion the genus *Garcinia,* as now constituted, ought not to be retained; a glance at the accompanying figures will explain my reasons for thinking so, by exhibiting in one view several of the incongruities which it presents. For example, the *Garcinia mangostana, speciosa,* and *cornea,* have the filaments of the male flower united, forming four large fleshy bodies covered with anthers, and two of the three are known to have a globose, not sulcated fruit. These might form the type of a genus under Rumphius' original name *Mangostana. G. Cambogia,* has the stamens of the male flower ranged in a single row,* round a disk-like receptacle, with a sulcated fruit. This might form the type of a second genus, for which, as nearly corresponding with the character assigned by Linnæus to his *Garcinia,* that name might be retained. In *G. Kydia, Zeylanica, pedunculata, paniculata* and *affinis,* the filaments are united into a staminal column, terminating in a head covered with anthers, fruit usually furrowed. These might form a third genus, retaining for them the now vacant name of *Cambogia*: and lastly, *G. pictoria,* Roxb. (*Mangost. morella* Gært?); *elliptica* Wall. (*fid.* Graham) and Dr. Graham's Ceylon plant, would form a fourth, distinguished by their united filaments, and cup-shaped, one-celled, circumscissile, anthers; for which the now vacant name, *Stalagmitis,* might be retained, in preference to disturbing Roxburgh's *Xanthochymus,* now well established, by rigidly enforcing the rule of priority, and restoring that of Murray, thereby causing considerable confusion in the synonymy, that might thus be easily avoided."

Since the publication of that article much additional light has been thrown on the subject through the publication by Dr. Graham of Edinburgh, in the 2d volume of the Companion to the Botanical Magazine, of a paper entitled " Remarks on the Gamboge tree of Ceylon and char-

* This I now find is an error; Roxburgh, when he prepared the figure of his *Garcinia Cambogia,* was unacquainted with the male flower, and only represents the bi-sexual one.

acter of Hebradendron, a new genus of Guttiferæ, and that to which the tree belongs."

This is an excellent paper, and embodying as it does much very interesting information, well repays the trouble of a careful perusal. I cannot however adopt Dr. Graham's conclusions as to the propriety of elevating this plant to the rank of a distinct genus, nor, supposing that abler botanists than either Dr. G. or myself consider ourselves, admit it as such into the system of plants, do I think his name can be adopted. The question, whether or not this is the Gamboge plant of Ceylon, I look upon as set at rest by the evidence adduced in the "Remarks." All therefore that I have now to consider are simply the following botanical questions—1st, whether this plant ought to form the type of a genus distinct from *Garcinia*?—and 2d, if so, whether it ought to receive a new name? The first of these questions I answer in the negative, because I do not think it sufficiently distinguished from *Garcinia* by the solitary character assigned—the peculiar structure of the anther. The second I equally answer in the negative, because this plant is undoubtedly the type of the genus *Cambogia* of Linnæus, whose name therefore ought to have been retained. My reasons for the first of these conclusions, being fully stated page 122 and 123 of my Illustrations, I subjoin the passage.

" If the precedent established by Dr. Graham in the formation of his genus *Hebradendron* be followed, we may, I fear, soon expect to see the off-sets from *Garcinia* about as numerous as its species now are, since that genus is separated on account of a variation in a single point of structure, and without reference to analogous forms met with in other species. The only point in which it differs from *Garcinia*, as defined in our Prodromus is—in having 1-celled circumscissile anthers—while the more usual form in that genus is to have them two-celled, with introrse, longitudinal dehiscence. Should this be considered a satisfactory reason for its removal, then *G. Kydiana* Roxb., which has a four-sided connectivum, with a polleniferous cell in each face, must equally be separated from the genus, as well as another species of which I possess specimens from Mergui, the anthers of which are 1-celled, dehiscing transversely across the apex. Another variation of structure, which has been long observed in a few species of the genus, will equally demand separation, as being of at least equal generic value; I allude to those in which the stamens of the male flower are united into four thick fleshy androphores, with a highly developed sterile pistil in the centre. Here then, assuming that we are justified in assigning generic value to such variations of structure, limited as they are to the male organization, are four distinct genera, and all, so far as such artificial characters can make them, equally stable.

I confess that I have an objection to this kind of excessive subdivision, inasmuch as, whatever rule holds good with respect to genera, must equally apply to orders, and must inevitably lead to the elevation of half our present species to the rank of genera, and an equal proportion of genera to natural orders; both of which might be avoided by a slight extension of our characters, and still better by a careful and comprehensive investigation of groups of allied species and genera, before attempting their disunion in the formation of new genera and orders. In support of these views, I think I may safely cite the recorded opinion of the first living authority, Mr. Robert Brown. He says, in a letter to Dr. Graham, referring to the plant which has called forth these remarks, "In your plant the structure of the anther is indeed very remarkable, and might well induce you to consider it a new genus; but it is right to add, that approaches to this structure, and which serve to explain its analogy with the ordinary structure of the family, exist in *Garcinia*, with which I suppose your plant would agree in its female flower as well as in fruit." From this concluding caution I imagine that, before establishing a genus on such grounds, he (Brown) would have ascertained the structure of the anther in the whole order, marked its variations, and then, and not till then, have determined on the propriety or otherwise of assigning a generic value to its variations: and I can scarcely avoid thinking, that, had such a course been followed in that instance, a sectional value only would have been awarded.

I confess that a less perfect examination of the order, than that which improved materials has now enabled me to effect, led me into a similar error; on which occasion, I proposed to subdivide the genus *Garcinia* into four distinct genera—*Garcinia*, *Mangostana*, *Cambogia*, and *Stalagmitis* (see *Madras Journal of Science*, vol. 4, page 304). This suggestion has not, so far as I am aware, been yet adopted by any one; and I trust it will not, as I now consider it wrong in principle, the variations in structure there pointed out, not meriting a higher than sectional value in a genus so strictly natural. Influenced by this reduced estimate of the relative value of the several structural variations mentioned above, it is my intention, on the present occasion, to keep the old genus together, but divided into sections in accordance with them. I am induced to do so from observing that the variations are limited to the male flowers, and do not on any occasion extend to the female. For example *G. Mangostana* and *G. cornea*, are referred to the same section; the former has 4-8 celled ovaries, and the latter usually 4; in *G. Kydiana*, Roxburgh describes the berry as being from 4 to 8 seeded, *G. Cowa* from 6 to 8, and most of the others are described as having as far as 4, or 8 seeds, showing a general want of uni-

formity in this respect: variations, therefore, of the number of the cells of the ovary, cannot be admitted as of generic, or even specific value in this genus. Should further acquaintance with the tribe show that, in uniting *Hebradendron* or rather *Cambogia*, Linn. (for they are the same genus, and the latter the more appropriate name) to *Garcinia*, I have erred, the error can be easily corrected, and, in the mean time, my sections will afford the means of more easily determining the known species, and of referring to convenient places such new ones as may be discovered. For the present, nothing is more difficult than to make out from description the species of *Garcinia*. This is mainly owing to the male flowers, which afford by far the best specific characters, being too little attended to in characterizing them. Generally speaking, they are dioicous, and, in collecting specimens, care should be taken to procure them of both sexes. The foliage, except in a very few instances, does not afford good discriminating characters, and when it does, is usually accompanied by others which are more to be relied upon."

My reasons for objecting to Dr. Graham's new name, to the prejudice of Linnæus' old one, is thus briefly explained at page 125 under *Garcinia Cambogia* and *Roxburghii*.

"I have not quoted Linnæus' *Cambogia Gutta* for either of these, though it seems the general opinion of botanists that it belongs to the former. This opinion, however, his brief description of the plant before him in the Flora Zeylanica, shows to be erroneous, and proves almost to demonstration that it is Dr. Graham's *Hebradendron*. The following are his words—*Rami oppositi. Folia lanceolato-ovata, integerrima, petiolata, opposita. Flores verticillati sessiles.* It is in truth the only plant of the genus in Ceylon, having sessile verticelled flowers. In his generic character he describes the anthers, *antheræ subrotundæ*, the pistil *germen subrotundum-striatum, stylus, nullus. Stigma quadrifidum, persistens*, and finally, the pericarp—*Pomum subrotundum, octies sulcatum, octoloculare*—showing clearly that the character of the flower and ovary is taken from one species, and of the fruit from a different, (or perhaps from Rheede's figure) owing to the imperfection of his specimens, and his not being aware that the lobes of the stigma afford a sure indication of the number of cells of the fruit. His *Cambogia*, however, barring this error, is certainly the Gamboge plant of Ceylon, which is further established, as Dr. Graham informs us, by the examination of the specimen in Herman's herbarium, "which may be considered the type of Linnæus' *Cambogia gutta*."—If, therefore, that plant is to be elevated to the rank of a genus, I should say his name ought unquestionably to be retained with an amended character, and botany relieved from the un-

seemly allusion conveyed under the new one. If Murray's *Stalagmitis* is on account of priority to supplant Roxburgh's *Xanthochymus*, much more must Linnæus' *Cambogia* supplant Graham's *Hebradendron*, partly for the same reason, priority, but principally, because Dr. Graham knew when he gave the name, that his plant was identical with that of Linnæus, while it was almost impossible that Roxburgh could ever recognize his *Xanthochymus* in Murray's character of *Stalagmitis*, made up as it is from two genera (*Garcinia* and *Xanthochymus*) so distinct as not to be referable even to the same natural order. In my opinion *Stalagmitis* ought to be suppressed, and *Xanthochymus* retained."

The allusion to *Stalagmitis* in this passage refers to the following sentence, which I quote from Dr. Graham's paper—"It appears then that the generic name of *Xanthochymus* must be dropped and that the species which belonged to this genus must (for the future) receive the appellation of *Stalagmitis*." This reasoning seems to have carried conviction to Dr. Lindley's mind, as he has acted upon it, so far as to append in his Flora Medica the name *Stalagmitis* to our (Wight and Arnott's) character of *Xanthochymus*, as being the original and legitimate name of the genus: but, apparently without due consideration, as, forgetting the rights of priority in the case of *Cambogia gutta* of Linnæus, he has followed Graham in quoting that name, without any doubt as to the identity of the plants, as a synonym for the very modern *Hebradendron Gambogioides* of Graham. Upon what grounds this degree of favour is to be shown to *Hebradendron* and withheld from *Xanthochymus* I am quite unable to discover or even to conjecture: that Dr. Graham should have inadvertently committed such an oversight is not so much to be wondered at, writing as he was under the excitement of having discovered the long sought Gamboge plant, and the novelty of inventing new generic names; but that Dr. Lindley should, in the retirement of his closet, and totally uninfluenced by the stimulus under which Graham wrote, have followed him without questioning the propriety of what he did, is to me surprising.

In my own and in the name of all working botanists, who are daily called upon to unravel the mazes of involved and perplexed generic names, I enter my protest against such unnecessary changing of names in a science already overburthened with them, and one too which must in its very nature become more and more so every day. To have assigned the name of *Hebradendron Gambogioides* to the very plant which Linnæus called *Cambogia gutta*, and then quote the original name as a synonym of the new one without doubt or question as to the identity of the plants, I hold to be such, and therefore consider it a duty to express—in terms less measured than my

own inclinations, not less than my esteem for the author, dictates—my sentiments regarding it; the more so, as I do not consider the genus itself a tenable one. To its goodness, or otherwise, however, I should not have thought it necessary thus to advert, if the old name had been retained; what I object to is, the inconsistency of, in the same breath, setting up a decidedly bad genus without a single genuine species to support it, for such I hold *Stalagmitis* to be, and putting down a supposed good one, resting on the very same foundation on which its successor is raised, the same species being the basis of both. In the case of Stalagmitis I object to the course pursued, on the ground of its being *ab origine* a spurious genus, constituted partly from notes taken from one species, the flowers of which the author of the genus (Murray) never saw, and partly from flowers of another which he examined, and then, with what ingenuity he was master of, invented from these heterogeneous materials a generic character not referable to either. That every thing might be in just keeping in this curious medley, it now appears, that he had for his only species a specimen made up of the fragments of two plants, no more fit to represent either correctly than his character could amalgamate the peculiarities of both, they being referable to two distinct natural orders. With all this information before him, and hunted out with much labour by Dr. Brown and himself, Dr. Graham, inconsiderately I should hope, tells us that the generic name of *Xanthochymus* must be dropped, and that of *Stalagmitis* put in its place, or, in other words, declares that we must put down a good genus and set up a non-entity, a genus without a species. That one of the two must be dropped is certain; but I hope botanists will show more consideration for the meritorious and diligent labours of Roxburgh, than to displace his really well defined generic name, in favour of one which nobody could understand, or apply from its own terms, and which, now that its inconsistencies have been brought to light, no one could adopt. As I have examined this question somewhat in detail, in a postscript to my article on the Guttiferæ, I shall subjoin it also, for the benefit of those who may not have the opportunity of consulting the original work, in the hope that, by thus calling attention to the subject, my remarks may have the effect of causing botanical authors to pause before they sanction, by adopting them, such uncalled for, and, I fear, if not opposed in time, likely to become mischievous, innovations—I now take leave of the subject, and sincerely hope I may not again have to revert to it.

P. S.—After this article was completed and the greater part of it printed, I received Lindley's "Flora Medica," a new work just issued from the press, and, like all the other works of the accomplished author, form-

ing a most valuable contribution to botanical science; on this occasion in connection with medicine. In this work I find Dr. Lindley has added the weight of his authority, to that of those who adopt Murray's *Stalagmitis* in preference to Roxburgh's *Xanthochymus.* This he does for the reasons adduced by Dr. Graham; namely, that Mr. Brown had examined Murray's specimen and ascertained that it consists of two plants, probably of two genera, one of which, in flower, is a *Xanthochymus,* the other, not in flower, supposed to be Graham's *Hebradendron.* Having expressed my belief that *Xanthochymus* does not belong to this natural order, and having no new species to add, nor other information to communicate respecting it, I did intend to have noticed that genus in this place. But as I have said above that, in my opinion, *Stalagmitis* ought to be suppressed and *Xanthochymus* established in its room, I feel now called upon to state more fully my reasons for thinking so—I shall commence by extracting from the "Companion to the Botanical Magazine" the passage of Mr. Brown's letter, quoted by Dr. Graham as his authority for saying that the generic name *Xanthochymus* must be dropped in favour of *Stalagmitis.* "The plant sent pasted by Konig to Sir Joseph Banks, as one specimen, I have ascertained to be made up of two plants, and very probably of two genera. The union was concealed by sealing wax. The portion in flower, and which agrees in structure with Murray's account, is, I have no doubt, the *Xanthochymus ovalifolius* of Roxburgh. *Stalagmitis* aud *Xanthochymus* are therefore one genus, as Cambessides has already observed, giving the preference to the earlier name of Murray. This, however, forms but a small part of the whole specimen, the larger portion being, I am inclined to think, the same with your plant, of which I have seen, and I believe still possess, the specimen you sent to Don.* The structure, however, of this greater portion cannot be ascertained from the few very young flower-buds belonging to it. It approaches also very closely, in its leaves especially, to that specimen in Hermann's herbarium, which may be considered as the type of Linnæus' *Cambogia gutta.* A loose fruit, pasted on the sheet with Konig's plant, probably belongs to the larger portion, and resembles Gærtner's Morella.

So far all appears clearly in favour of *Stalagmitis,* and had Murray in drawing up his character rigidly confined himself to the description of the flowers before him, I should at once have adopted his name in preference to Roxburgh's. But on turning to his character, as given in Schreber's Genera Plantarum, we find a 4-leaved calyx, a 4-petaled corolla, and a 4-lobed stigma, combined with pentadelphous stamens, 3-

* One of those received from Mrs. Walker.

seeded berries, the stigmas sometimes trifid: stamina not always polyadelphous? &c. From this very unusual combination of quinary and quaternary, forms I am led to infer that the character is only partly derived from the specimen, and partly, if not principally, from notes communicated by König, who, it appears, from the fact of his having combined, on the supposition that they were the same plant, two distinct species, was not aware of the difference, and misled Murray by communicating written characters of a *Garcinia*, and flowers of another plant, and between the two, there has resulted a set of characters not likely to be often found combined in the same species, and still less frequently in one small specimen. Roxburgh, on the other hand, briefly and clearly defines a genus of plants well known to him, and extensively distributed over India, about which he has scarcely left room for a mistake. If further proof be wanted in support of the opinion I have advanced that this is a hybrid genus, I adduce Cambessides, whose authority is quoted for the identity of *Stalagmitis* and *Xanthochymus*. He has strictly followed Murray, adopted all the contradictions of his character, and constituted a genus embodying, first, Roxburgh's genus *Xanthochymus*, next, Petit Thours' *Brindonia*, evidently identical with *Garcinia*; then Loureiro's *Oxycarpus*, also *Garcinia*; and lastly, (if I am not misled by Mr. George Don, whom I am obliged for want of Cambessides own memoir to follow) nearly the whole of Roxburgh's species of *Garcinia*; as if Roxburgh was so bad a botanist as not to be able, with growing plants before him, to distinguish between two genera so very distinct as *Garcinia* and his own *Xanthochymus*. In a paper which I published in the *Madras Journal of Science* for October 1836, I showed, from the internal evidence afforded by the two sets of characters, that Murray's *Stalagmitis* and Roxburgh's *Xanthochymus* were partly identical, and attributed the discrepancies to defects of Murray's solitary specimen; a view, which Mr. Brown has shown to be only partly right, by proving that they in some measure originated in the imperfect observation of König, who supplied Murray with the materials for his genus.

Having now adduced what I esteem conclusive evidence in support of the opinion I advanced above, that Murray's genus is spurious, and that of Cambessides, founded on it, is most unnatural, as associating species that never can combine generically; while Roxburgh's is a strictly natural genus, including several nearly allied species, and, moreover, probably referable to a natural order different from more than half of the species referred to it under the name of *Stalagmitis* by Cambessides: I consider myself fully justified in continuing to adopt the generic name *Xanthochymus* (even though opposed by the highest botanical authorities) until careful examination of the original specimen, with reference to the elucidation of the discrepancies I have indicated, shall have proved that

such actually exist in *that* specimen. If they do exist, then the fault is not Murray's, and his name must of right be adopted with an amended character, excluding the numerous species of *Garcinia* brought under it by Cambessides: if they do not, Roxburgh's genus, which as it now stands is strictly natural, claims the preference.

On the Laurus Cassia of Linnæus, and the plants producing the Cassia Bark of Commerce.

The next subject on which I have some remarks to offer is the *Laurus Cassia* of Linnæus, and the plants producing the *Cassia Lign ea* or Cassia bark of commerce. My attention was first directed to this subject by a communication from Government, in which I am requested to endeavour to ascertain "whether the common Cassia bark of the markets of the world is a thicker and coarser portion of the bark of the genuine cinnamon plant or tree, or whether it is the bark of a plant not analogous to the cinnamon plant or tree."

Before it was possible to return a satisfactory answer to this question, it seemed incumbent on me to ascertain what plant Linnæus meant to designate under the name of *Laurus Cassia*, and whether it was probable the plant so called could supply all the bark passing under that name in the markets of the world. This primary, but most difficult inquiry was rendered indispensable by the, generally supposed, ridiculous assertion of Mr. Marshall, that the leaves, and the bark of the trunk and branches of the *Laurus Cassia* of Linnæus, so far from being aromatic and spicy like cinnamon, are bitter and have in a slight degree the taste and odour of myrrh. This assertion, wide as it may appear of the truth, is yet founded in fact, and what may appear still more extraordinary, has led to a discovery, which, without such aid as he has given, would not probably have soon been made by a professed botanist, a title to which I believe Mr. Marshall does not aspire. He appears to have been led to the discovery, that the *Laurus Cassia* of Linnæus did not produce aromatic bark, simply through the native name, and wonders how it could have received from him the name of *Cassia*, and had qualities attributed to its bark which it does not in the slightest degree possess. I think I can now answer the question, and explain the mystery which has so long hung over this species, and been hitherto rendered only more obscure by each attempt to bring it to light.

It is well known to modern botanists, that many of their earlier predecessors were but indifferent describers of plants, and often very loose in their quotations of figures as synonyms, a sin of which Linnæus was often about as guilty as any of his cotemporaries. He seemed to have had an idea, that their figures were generally at best but approximations to

the truth, and that if a figure exhibited even a remote similarity to a plant before him, especially if from the same country, he might with safety quote it as a synonym. Bearing this in mind, we can easily account for a number of errors to which his incorrect synonyms have given rise. The present instance affords an excellent example of what I have here stated, and one which, but for the discovery of Mr. Marshall, might have long remained undetected.

In Hermans herbarium of Ceylon plants, he (Linnæus) found one bearing the native names of "Dawalkurundu, Nikadawala" under which, it is referred to, or described in Hermans Musæum Zeylanicum. This he considered a species of *Laurus*, apparently from habit alone, and in his usual brief precise style, calls it, Laurus foliis lanceolatis trinerviis nervis supra basin unitis ; having previously called the true cinnamon, "Laurus foliis ovato-oblongis trinerviis basi nervos unientibus." The difference between the two, as indicated by the names, seems very slight, merely depending on the one having lanceolate leaves with the nerves united above the base ; while in the other the leaves are said to be ovate oblong with the nerves distinct to the base—differences small indeed, and such as could never be found of much avail in distinguishing the one plant from the other, since they are both constantly met with in different leaves on the same tree. Such being the case, it is not much to be wondered at that botanists should have been surprised by the boldness of Mr. Marshall's announcement, that two trees, believed to be of the same genus, and so nearly alike in their external forms, should yet differ so very widely in their properties. But so it is, and nothing can be more certain than that the fact is as he states it.

In proceeding to trace the history of the two species, aided by the light Mr. Marshall has thrown on them, our difficulties vanish like mist before the noon-day sun, though Mr. M. himself, has found it "difficult to conceive how the Dawalkurundu obtained the appellation of *Laurus Cassia* from Linnæus." It was because Linnæus's specimen of Dawalkurundu was neither in flower nor in fruit. Had it been so, he was too acute an observer ever to have confounded it with the plants with which he has associated it in his synonyms. This explanation, it may be answered, is mere assumption on my part—it certainly is so, but supported by so strong circumstantial evidence, as not to leave a doubt of its correctness. Linnæus has in his Flora Zeylanica given a short description of each of these species : his description of the cinnamon is principally confined to the flower, and is most precise. In his description of the other, the flower is not once alluded to. Here he declares, that he knows not by what mark to distinguish it from the *Camphorifera japonensium*, which

in its foliage it greatly resembles, but nothing can be more distinct than its inflorescence: that of the camphor tree being a panicle, having a stalk as long as the leaves; while in Dawalkurundu it may be described as a subsessile capitulum, that is, 5 or 6 sessile flowers congested on the apex of a very short peduncle, and surrounded by an involucrum of 4 or 5 leaves; several of which capitula usually form verticels round the naked parts of the branches where the leaves have fallen. He begins his description of *Laurus Cassia** by stating that he at first considered it a variety of the antecedent (cinnamon), but now that he knows not by what mark to distinguish it from *Camphorifera japonensium*, for the leaves are thinner than those of cinnamon, the nerves uniting above the base as in *Camphorifera*, and are sprinkled beneath with a greyish dew *(subtus rore cæsio illinita)* as in the camphor tree, and are at the same time lanceolate and of a thinner texture than the preceding (cinnamon). The whole of his description in short agrees most exactly with Mr. Marshall's description of the Cingalese Dawalkurundu, and leaves not a doubt that both had the same plant in view, and consequently that Mr. Marshall is so far correct in saying that the bark of the *Laurus Cassia* of Linnæus possessed none of the qualities attributed to it. So far all is clear but now the chapter of errors begins.

Had Linnæus been permitted to exercise his own unbiassed judgment in this case, it is not improbable he would have avoided the error of assigning to a plant which, with all his acuteness, he knew not how to distinguish from the camphor tree, the credit of producing Cassia, or at all events would not have done so without some expression of doubt, so as still to leave the question an open one. But, upon consulting other authorities, he found in Burman's Thesaurus Zeylanicus the figure of a species of *Cinnamomum* or *Laurus* as he called the genus, to which Burman had given the name of *Cinnamomum perpetuo florens*, &c. and assigned the native name of Dawalkurundu, not as it appears from the specimen itself having been so named, but because being different from the true cinnamon of which he had seen specimens and figures, he thought it an inferior, wild or jungle sort, and must of necessity be the plant which Herman had described in his Musæum Zeylanicum, though the inflorescence differed much from the description, (a very essential point, which Burman remarked and endeavours to explain away,) and therefore gave it the same Cingalese name. Linnæus's specimen not being in flower, and the resemblance between the specimen and figure being in

* "Hanc speciem olim pro antecedentis varietate habui, nunc vero, qua nota hanc a *Camphorifera japonensium* distinguam, non novi; Folia enim Cinnamomo tenuiora, nervis ante basin coeuntibus ut in Camphorifera; subtus rore cæsio illinita, ut Camphora, et simul lanceolata ac tenuiori substantia quam præcedentis."*Linn. Flor. Zeylanica p.* 62.

other respects considerable, he had not the means of detecting the discrepancy, and unsuspectingly adopted Burman's figure and name as a synonym to his plant. In Rheedes Hortus Malabaricus (1 tab. 57) he found the figure of another cinnamon, even more closely resembling his plant in its general aspect than Burman's figure, this he also associated as a synonym; and Rheedes' plant being lauded on account of the aromatic properties of its bark and leaves, which resemble the true cinnamon, though it is not the genuine cinnamon tree, he seems to have considered himself quite safe in associating this also, and called the three species, this tria juncta in uno plant, *Laurus Cassia*, and assigned it as the source of the officinal " *Cassia Lignea cortex.*"

After this exposition of the origin of the species *Laurus Cassia*, it can scarcely be a matter of surprise that no two botanists have ever agreed as to the plant which ought to bear the name: nor, that not one of them should ever have surmised what plant Linnæus had constituted the type of his species. It is not my intention on the present occasion to extend these remarks, by tracing the various conjectures that have been promulgated on the subject; suffice it to say that no one, so far as I am aware, has taken a similar view as that now explained. It only further remains for me to give some account of the three species thus erroneously associated.

The first mentioned, Dawalkurundu, Linnæus' own plant and the type of the species is, I believe, the *Laurus involucrata* of Vahl, and of Lamark in the Encyclopédie Méthodique, and has in Professor Nees' monograph of the Indian Laurinæ (Wall. Plant. As. rariores), received the name of *Tetradenia Zeylanica*, but is the *Litsea Zeylanica* of a former work of his, a name, which I presume must be restored, owing to the other being preoccupied. The slight difference of structure does not seem to render a new genus necessary.

The second and third have both been referred, by the same eminent botanist, to his variety of the true cinnamon, the *Cinnamomum Zeylanicum*, a decision to which I cannot subscribe, as I cannot perceive that either of these figures are referable to any form of that species, and they besides differ specifically from each other.

The *Cinnamomum perpetuo florens* appears to me a perfectly distinct species, very nearly allied to, if not actually identical with, Nees' own species *C. Sulphuratum*, of which I have now got specimens from Ceylon. This I infer from the appearance of the plant as represented in the figure, for if any dependence is to be placed on the description, it is impossible to admit it into the genus. On this however, I do not feel disposed to place much reliance, as it was not the practice a century ago,

when the description was written, to examine the structure of flowers with the same care that is now bestowed. Should it be objected, that the species I quote as the *C. perpetuo florens* is clothed with yellowish pubescence, which is not mentioned by Burman, then I have another from the same country (Ceylon) perfectly glabrous, agreeing in the form of its leaves, but differing in having more numerous and smaller flowers, which may be substituted, and that I do not think, more than the other, a variety of the genuine cinnamon tree.

The Malabar plant Carua (Hort. Mal. 1. tab 57), on the other hand, I consider a very passable figure of a plant, in my herbarium named, by Nees himself, *Cinnamomum iners* ; but, whether or not I am right in the species to which I have referred it, I can have no hesitation in giving it as my opinion that it is not referable to any form of the *C. Zeylanicum* ; neither can I agree with him in thinking the plant figured under the name of *Laurus Cassia* in the Botanical Magazine No. 1636 is referable to the Ceylon species, but is I think very like the Malabar one, the only species of the genus to which the name *Cassia* should be applied, if that name is still to be retained in botanical nomenclature, as being the only one of the three associated species known to produce that drug. Another plate of the Botanical Magazine (*Laurus Cinamomum* No. 2028) I also refer here, and feel greatly at a loss to account for its introduction into that work under a different name from the preceding. The plant which Nees formerly considered the *Laurus Cassia*, but now calls *Cinnamomum aromaticum*, from China, is a very nearly allied species, but is distinct, and furnishes much of the bark sold in the European markets under the name of Cassia, tho' it has nothing whatever to do with the *Laurus Cassia* of Linnæus, which, from the preceding history appears strictly confined to Ceylon and India proper, and that name, not being referable to any one species, ought unquestionably to be expunged from botanical nomenclature, its longer continuance there only tending to create confusion and uncertainty. This brings me to the next question—namely, what plant or plants yield the Cassia bark of commerce?

The foregoing explanation, in the course of which two plants are referred to as yielding Cassia, greatly simplifies the answer to this one. The first of these is the Malabar Carua figured by Rheede, the second Nees' *Cinnamomum aromaticum.* The list, however, of Cassia producing plants is not limited to these two, but I firmly believe extends to nearly every species of the genus. A set of specimens, submitted for my examination, of the trees furnishing Cassia on the Malabar Coast, presented no fewer than four distinct species ; including among them the genuine

cinnamon plant, the bark of the older branches of which, it would appear, exported from that coast as Cassia. Three or four more species are natives of Ceylon, exclusive of the cinnamon proper, all of which greatly resemble the cinnamon plant, and in the woods might easily be mistaken for it, and peeled, though the produce might be inferior. Thus we have from Western India and Ceylon alone, probably not less than six plants producing Cassia ; add to these nearly twice as many more species of cinnamomum, the produce of the more eastern states of Asia and the Islands of the Eastern Archipelago, all remarkable for their striking family likeness, all I believe endowed with aromatic properties, and probably the greater part if not the whole contributing something towards the general result, and we at once see the impossibility of awarding to any one individual species the credit of being the source whence the *Cassia Lignea* of commerce is derived ; and equally the impropriety of applying to any one of them the comprehensive specific appellation of Cassia, since all sorts of cinnamon-like plants, yielding bark of a quality unfit to bear the designation of cinnamon in the market, are passed off as Cassia.

VI.—*Report upon the Run of the Sea, and Set of the Tides at Madras during the North-East Monsoon.*—*By* T. G. Taylor, Esq. *Honorable Company's Astronomer.*

To do justice to an enquiry of this nature, it will no doubt be considered necessary that observations should have been continued throughout several monsoons, whereby a knowledge of maximum and minimum effects would have been attained—instead of the particular ones which have been observed in the monsoon of 1838, upon which this report entirely depends; it hence appears necessary that the particulars of the weather experienced in the monsoon of 1838 should first be stated.

The S. W. wind continued to blow steadily up to the 16th October, on which day the N. E. wind set in in a somewhat abrupt and threatening manner ; but, relaxing again on the 17th to the S. and S. W., the weather continued fine until the 24th, when the wind again shifted to the N. E. : from this day (which may be considered the commencement of the monsoon) up to the 10th December, when fine weather again returned, the subjoined meteorological register will exhibit the nature of the weather experienced.

Days.	Barometer at			Thermometer at			Rain.		Direction of wind.		
1838	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun rise.	Sun set.	10 A. M.	4 P. M.	10 P. M.
	Ins.	Ins.	Ins.	°	°	°	Ins.	Ins.			
Oct. 24	30,010	30,028	30,062	83,3	85,0	82,0			N E	N E	N E
25	074	000	024	84,0	85,0	80,3			N E	E	N
26	022	29,974	000	81,7	84,0	82,5			N E	N E	N
27	018	948	29,994	79,3	81,6	79,5	1,174	0,467	N	——	N
28	008	—	998	78,6	—	79,3	0.367	0,535	N. N E	——	N
29	036	960	30,018	78,6	80,0	78,7	0,147		N	N	N W
30	068	990	056	79,0	79,4	78,2	0,934	0,117	E	N	N
31	040	980	024	78,7	79,6	79,4	0,944		N W	N	N
Nov. 1	016	978	29,990	80,4	82,5	78,5	0,217		N E	N E	Calm
2	008	958	30,000	80,7	83,8	79,9			N W	N E	
											N E
3	008	954	29,998	81,4	84,0	80,3			N W	N W	N
4	024	—	30,000	78,0	—	78,9	0,667	0,167	N E	——	N W
5	29,990	930	29,976	77,6	76,2	76,4	5,009	0,637	N	N W	N
6	948	910	906	76,5	77,0	76,5	1,382	0,994	N E	N W	N
7	920	876	916	77,7	79,8	78,4	4,700		S W	S E. E	E
8	952	890	940	80,7	81,8	79,1	0,067		E	E	N E
9	966	902	958	80,1	82,0	79,9	3,825	0,037	E	E	N E
10	30,034	914	30,000	78,2	79,0	78,3	1,044	0,067	E	E	N W
11	033	—	003	78,8	—	79,8	1,534	0,107	N. N W	——	N
12	063	964	028	78,2	79,4	78,3	0,127	0,147	E. S E	E	N
13	076	990	064	81,8	81,4	79,7	0,247		N E	E	N E
14	090	30,000	090	81,6	79,9	79,7			N E. E.	N E. E	N E. E
15	124	006	068	77,5	79,9	78,3	0,187	0,377	N	N	N E
16	102	002	088	81,1	80,5	79,5			N E	N E	N E
17	110	022	078	80,8	80,8	79,3			N E	N E	N E
18	076	—	076	78,8	—	77,7			——	——	N E
19	067	012	056	79,5	79,4	77,6			E	N E	N
20	030	29,958	003	78,2	80,0	78,0			N	N	Calm
21	29,982	940	29,952	76,3	78,8	74,7			N. N W	N	do
22	30,014	960	30,006	76,9	79,6	76,0			N. N W	N E	do
23	062	974	033	77,2	79,5	73,5			W	N E. E	do
24	088	986	035	76,4	79,5	76,0			N	N E	N E
25	077	—	054	77,2	—	75,7			E	——	N
26	100	30,004	086	77,3	78,0	76,3			N	N E	N E
27	112	046	126	79,1	80,4	77,3	0,147		N E	E	N E
28	156	072	140	76,3	79,0	78,2	0,091		N W	N E	N E
29	126	042	124	79,0	78,8	76,5			N	E. N E	E N E
30	120	042	114	78,3	78,8	77,5	0,117		N. N E	N. N E	N E
Dec. 1	105	016	072	77,8	78,5	75,7			E. N E	N E	N E
2	086	—	068	76,0	—	76,1			N W	——	N W
			008	77,8	78,8	77,8			N. N W	N. N W	N
3	058	29,990									
4	016	944	29,978	78,7	79,8	76,7			N W	N W. N	N
5	29,968	924	944	76,1	78,0	76,4	0,190	0,317	N	N	N
6	950	*874	906	75,1	76,5	75,7	1,781	0,232	N. N W	N. N W	N N W
7	*896	910	998	75,8	76,8	76,7	1,634	0,067	W. N W	S	S E
8	30,084	988	30,050	78,8	81,0	77,8			E. S E	S E	E N E
9	062	—	050	78,8	—	77,7			N E	——	N E
10	090	004	108	78,7	80,0	77,8			E	E	N

N. B.—The correction for cappillarity which remains to be applied=×,026.

* A very high sea and terrific surf—there had evidently been a strong gale of wind in the neighbourhood. One dhoney came ashore and the Brig Maingay, having broke her anchor, was obliged to put to sea.

Cloudy Max. 10.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 A. M.	
5	Fl. cl.	Clear	Haze	
3	Clear	do	Clear	Lightning to the E. at night.
7	Cloudy	Cloudy	Cloudy	Thunder and lightning to the E. do.
	Driz. rain	——	Driz. rain	Do. do. do.
9	do do	——	Fl. cl.	Lightning do.
9	do do	Cloudy	Cloudy	Do. do.
10	Cloudy	do	do	Do. and rain do.
6	Th. haze	do	Fl. cl.	do.
3	Cloudy	Fl. cl.	Clear	Heavy dew.
5	do	Haze	Haze	Dew.
7	Fl. cl.	Fl. cl.	Driz. rain	Thunder and lightning at night.
9	Rain	——	do do	Do. do. do.
10	Cloudy	Cloudy	do do	Squally day and night.
9	do	Rain	do do	Heavy rain evening and night.
5	do	Th. haze	Clear	Vivid lightning do.
9	Fl. cl.	Cloudy	Cloudy	Vivid lightning and one loud and terrific crash of thunder at 7 P. M.
9	Cloudy	do	Fl cl.	Lightning at night.
9	do	do	Driz. rain	Do. do.
8	do	——	Fl. cl.	Thunder and lightning do.
8	Rain	Cloudy	Cloudy	Do. do. do.
6	Fl. cl.	do	Clear	Lightning do.
8	do	do	Rain	Thunder and lightning do.
7	Cloudy	Driz. rain	Clear	Lightning do. with rain.
7	Fl. cl.	Cloudy	Fl. cl.	Do. do.
6	Clear	Fl. cl.	Fl. cl.	}
5	——	——	Clear	} Hazy.
5	Fl. cl.	Fl. cl.	Haze	}
6	do	do	Th. haze	}
5	Th. haze	Th. haze	Clear	Heavy dew.
5	do do	do do	Haze	Do. do.
3	Haze	Haze	Clear	Do. do.
	Clear	Clear	do	Do. do.
1	do	——	do	Do. do.
6	Cloudy	Cloudy	Cloudy	Drizzling rain at night.
5	F. cl.	Fl. cl.	Fl. cl.	do.
5	do	Cloudy	do	}
10	do	Driz. rain	Rain	}
6	Cloudy	Cloudy	Fl. cl.	}
3	Fl. cl.	Fl. cl.	Fl. cl.	} Generally cloudy throughout the night, wind strong at times.
7	do	——	Cloudy	}
8	Haze	Cloudy	do	}
7	Fl. cl.	Fl. cl.	do	} Squally.
8	Rain	Cloudy	do	
10	do	Rain	do	Strong wind or light gale at night—thunder & lightning.
9	do	Cloudy	do	Lightning.
5	Fl. cl.	Fl. cl.	Fl. cl.	Do.
3	do	——	do	Do.
3	do	Fl. cl.	do	

On comparing the foregoing register with similar ones during the last forty years, it appears that the monsoon of 1838 has not been particularly distinguished—either for its severity or mildness; and from the evidence of the shipping in the roads, it would appear that a monsoon of full ordinary strength has been experienced. With regard to the particulars of the observations from which this report has been drawn up, I may at once proceed to state, that

The Site chosen for making the observations, was a long range of verandah, situated in front of the Sea Custom House and Master Attendant's Office; at about 200 feet from the edge of the sea and 29 feet above its mean level—immediately opposite to the spot on which stones had been thrown down for the proposed breakwater. On this verandah two stations were selected, 205 feet apart (which I have distinguished as the north and south end of the verandah), from which I was enabled to determine the situation of buoys, &c.

The Instruments employed on shore, were, a five feet achromatic by Dollond (fitted with circles of 4 in. diameter, reading off to minutes, for the measurement of altitude and azimuth, and supplied with a position and double wire micrometer), and a 9 inch theodolite by Dollond—both circles reading off to minutes.

The Apparatus employed at sea, consisted of a small iron buoy (No. 1), anchored in 18 feet water, immediately opposite to and 828 feet distant from the S. station; and a similar one (No. 2), situated at 1131 feet distance from the same, and exactly in a line with No. 1: both of these buoys were held to their anchors, with 6 inch coir cable of 18 fathoms in length. In addition to this, a canoe of 16 feet in length, decked over and well caulked, was anchored opposite to, and 1200 feet distant from the north station; the canoe was furnished with a slender rod of 8 feet in length, nailed to the deck at right angles to its length, for the purpose of indicating the direction of the current; and an apparatus (fig. No. 1) for measuring its velocity:—where A represents an iron flanche, which is screwed on to the stern of the canoe and supports a double jimbol E, on which the connected iron rods D B and B C and wooden bob C, are free to move in every direction. In the case of no current—E

C would be perpendicular ; and corresponding to any given angle of inclination, it might readily be computed what was the velocity of the current: the rod E C being situated *in* the water, it was necessary to attach an index D B (whose inclination could be read off with the position micrometer attached to the 5 feet telescope).

The Times proper for making the observations were next to be considered ; with regard to the tides, the observations on the days near to the new and full moon and at the quarters were evidently the most proper ; and for the set of the sea, those days in which the surf was higher than usual should evidently be adopted ; hence I selected the days following the 1st, 2d, 3d and 4th quarters of the moon, when hourly observations from 6 A. M. to 6 P. M. should be regularly registered, and on any intermediate days in case of a higher surf than ordinary.

The Run of the Sea has been measured by taking the difference between the greatest and least angles of depression of the iron buoy No. 1, which (as has been already stated) was anchored in 18 feet water with 18 fathoms of cable ; these differences being reduced into feet, are as follows :

1838	Remarks.	6h.	7h.	8h.	9h.	10h.	11h.	12h.	1h.	2h.	3h.	4h.	5h.	6h.
		F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.
October 16	Rough sea						4 9							
26							4 3			5 3		4 3		
27	Squally		4 6	4 9	4 4	4 4	4 9	4 9	4 9	4 9	4 9	4 1	3 6	4 4
November 3		4 7	3 4	3 2	3 2	3 2	2 4	3 4	4 1	4 1	3 4	2 9	3 9	
10	Very calm					1 9	2 2							
19			3 2	3 4	3 0	3 2	3 2	2 7	3 2	3 2	3 2	2 4	2 4	
26			2 2	2 4	2 2	2 4	2 0	2 2	2 4	2 6	3 2	3 0	3 2	
December 3	High surf		4 7	4 7	4 7	4 7	5 0	5 0	4 7	4 7	4 3	5 0	5 0	

On the morning of the 6th December the sea and surf had risen to an unusual height, but the only remaining buoy having been washed on shore, I was unable to make further observations. The difference in height between the summit and lowest point of the breakers could not have been less than 8 or 10 feet. Breakers or surf extending ¾ mile from the shore.

The Velocity of the Current.—It was my intention, to have measured the velocity of the current by the "*Indicator*" as already explained ; but, either the iron work was not sufficiently strong, or it offered too great a temptation to some thievish catamaram man,—for the

canoe was overset, and the Indicator wrenched off on the morning of the 2d November; and the canoe itself broke from its mooring and came ashore on the following day: thus circumstanced, I have caused a catamaram from time to time to be left to float over a measured space, from which the velocity of the current has been computed; thus—

Date.		Velocity.		By what means measured.
Octr. 1 at 11	A. M.	No percep.current.		By catamaram
16—11	——	0,80 miles per hour		do
25—11	——	1,30	,,	do
26—11	——	2,50	,,	By Massy's Patent Log
26— 1	P. M.	2,52	,, *	By catamaram
27— 7	A. M.	1,87	,,	By Indicator
—— 8	——	1,87	,,	do
—— 9	——	1,87	,,	do
——10	——	1,87	,,	do
——11	——	1,87	,,	do
——12	——	1,90	,,	do
—— 1	P. M.	2,50	,,	do
—— 2	——	2,50	,,	do
—— 3	——	2,50	,,	do
—— 4	——	2,90	,,	do
—— 5	——	2,90	,,	do } The catamaram men re-fused to go off; but on being urged made the attempt;—after being washed off three times, they lost their catamaram which came ashore near the fort, leaving the men to swim ashore.—Rate of floating about 3 miles per hour.
Novr.3 11	A. M.	1,50	,,	By catamaram
5	P. M.	3,00	,,	do
8 11	A. M.	2,01	,,	do
19 11,30	A. M.	1,40	,,	do
5,30	P. M.	1,30	,,	do
26 11,30	A. M.	0,76	,,	do
5,0	P. M.	1,40	,,	do
Decr. 3 11,30	A. M.	0,90	,,	do
4,30	P. M.	1,40	,,	do

THE TIDES.—The apparatus for determining the times of high and low water, was a pile of 34 feet in length; which I had intended should be driven in the sea at about 300 yards from the shore: to the upper end of this pile was attached a hollow iron cylinder of 8 feet length, closed at the bottom—which would always be under water—with the exception of a very small hole; and an aperture left in the top (which

* At 5 P. M. the current had evidently increased in strength, insomuch that the catamaram men refused to go off—saying they could not reach the nearest buoy under two hours.

The direction of the current noticed in the above, was generally parallel with the shore, but on one or two occasions I fancied it had a slight inclination (to the amount of 2 or 3 degrees) *towards* the shore.

would be above water) so as to admit a slight rod to pass freely; this rod being attached to a light hollow copper box—which would float on the surface of the water within the cylinder,—the variation in height of its upper end, would indicate to an observer on shore the variation of the level of the sea, &c. This apparatus was got ready and one attempt made to drive it, but the want of proper anchors, &c. produced a failure, and up to the present time I have not been able to procure the needful to make a second attempt. Under these circumstances I may be permitted to offer observations, which, although not nearly approaching to that degree of accuracy which might be desired, still will supply usefully approximate results. The observations to which I allude consist in deducing from the observed depressions of the sea and buoys, the height of the telescope above the level of the sea; thus, on the 3d of November at 6 A. M., I observed the line of floatation of the buoy No. 1 to be depressed 2° 5′ below the horizon of the sea, hence

	°	′	″	
Depression below the sea	2	5	0	
Dip		5	30	
Depression below the horizon	2	10	30	nat. sin.=,03796

distance of object—× 828 feet

height of telescope above the sea— 31.43 feet

Observed elevations of the Station above the level of the Sea and distance from the shore at which the outer Surf broke.

Date.	Observed with theodolite.			5 feet achromatic.		Remarks
	1st buoy	2d buoy	Surf bks.	Canoe	1st buoy	
1838	Feet	Feet	Feet	Feet		
October 27 at 7 H. A.M.	32,50	33,06	287	32,78		
8 ,,	32,50	32,30	255	32.78		
9 ,,	33,23	33,06	295	33,31		
D. H. M. 10 ,,	33,23	33,40	375	33,13		
(☾ Oct. 26 2 19) 11 ,,	32,26	32,24	373	32,47		
12 ,,	32,02	32,06	460	32,11		Sea too high for catamarans.
1 P. M.	32,02	31,75	420	32,11		
2 ,,	31,54	31,75	390	31,77		
3 ,,	31,92	31,75	330	31,61		
4 ,,	32,44	31,92	326	32,11		
5 ,,	33,02	32,50	282	32,61		
Mean.................	32,43	32,53		32,44	Feet Mn 32,47	
Maximum..............	33,23	33.06	460	33,31		
Minimum..............	31,54	31,75	255	31,61		
Difference..............	1,69	1,31		1,70	Mn -1,57	

Approx. time of high water	h. m.	h. m.		h. m.	h. m.
	2 0	2 0		2 30 or mean—2 10	

☾ culminates at 7 8

High water bef. ☾ culm. 4 58

Date.	Observed with theodolite			5 feet achromatic.		Remarks.
	1st buoy	2d buoy	Surf bks	1st buoy	2d buoy	
1838	Feet	Feet	Feet	Feet	Feet	
November 3 at 6 A.M.	31,43	31,94	206	32,47	32,41	
7 ,,	31,18	31,57	206	32,21	32,07	
8 ,,	31,06	31,57	206	31,06	30,98	
D. H. M. 9 ,,	30,83	30,89	206	30.87	30,64	
(○ Nov. 2 5 46) 10 ,,	31,31	31,22	245	30,37	32,01	
11 ,,	31,55	32,25	276	31,21	31,97	
12 ,,	32,79	32,76	340	32,27	32,97	
1 P.M.	33,23	33,11	340	32,97	32,48	Rather high surf
2 ,,	33,47	33,97	370	33,70	33,19	
3 ,,	33,23	33,97	397	33,20	33,19	
4 ,,	32,99	33,66	397	32,84	32,89	
5 ,,	32,54	32,94	340	32,62	32,27	
Mean..................	32,14	32,42		32,19	32.25	Mean—32,77
Maximum..............	33,97	33.97	397	33.70	33,19	
Minimum..............	30,89	30,89	206	30,87	30,64	
Difference..............	2;64	3,08		2,83	2,55	Mean—2,25

Approx. time of high water	h. m.	h. m.		h. m.	h. m.	h. m.
	8 30	9 0		9 30	8 30 or mean—8 52	

☽ culminates infr. 12 53

High water bef. ☽ culm. 4 1

Observed elevations of the Station above the level of the Sea, &c.

Date.	Observed with theodolite. 1st buoy		Surf bks	5 feet achromatic 1st buoy		Remark.
1838	Feet		Feet	Feet		
November 19 at 7 A.M	31,31	*	308	30,82	*	
8 ,,	30 58		332	30,70		
9 ,,	31,07		291	30,94		
10 ,,	31,79		308	31,66		
11 ,,	32,03		357	31,90		
D. H. M. 12 ,,	32,51		295	32,15		
(● Nov. 17 1 23) 1 P.M.	32,75		338	33,10		
2 ,,	32,99		338	33,10		
3 ,,	33,23		343	33,58		
4 ,,	32,75		310	33,20		
5 ,,	32,75		290	32,62		
Mean..................	32,16		·	32,16		feet Mean=32,16
Maximum..............	33,23		357	33,58		
Minimum..............	30,58		290	30,70		
Difference.............	2,65			2,88		Mean=2,76

Approx. time of high water: h. m. 8 30 — h. m. 8 0 or mean=8 h. m. 15

☽ culminates 1 22

High water bef. ☽ culm 5 7

Mem.—The outer buoy had broken from its mooring and come on shore on the morning of the 17th.

Date.	Observed with theodolite. 1st buoy		Surf bks	5 feet achromatic. 1st buoy		Remarks.
1838	Feet.		Feet.	Feet.		
November 26 at 8 A.M.	32,		—	—		
9 ,,	32,51		252	33,00		
10 ,,	32,75		260	33,20		
11 ,,	33,23		267	33,92		
D. H. M. (☽ Nov. 24 11 53) 12 ,,	32,51		265	32,96		
1 P.M.	32,27		260	32,48		
2 ,,	31,55		268	32,00		
3 ,,	31,55		316	31,52		
4 ,,	31,31		311	31,04		
5 ,,	81,11		296	31,76		
Mean	32.16			32,43		feet Mean=32,30
Maximum..............	33,23		316	33,92		
Minimum..............	31,31		252	31,04		
Difference..............	1,92			† 2,88		

Approx. time of high water: h. m. 3 30 — h. m. 4 0 or mean—3 h. m. 45

☽ culminates..7 30

High water bef. ☽ culm. 3 45

* The second or outer buoy had parted from her anchor and come ashore.

† This result is evidently too large and had better be omitted.

Observed elevations of the Station above the level of the Sea, &c.

Date.	Observed with theodolite. 1st buoy	Observed with theodolite. Surf bks.	5 feet achromatic. 1st buoy	Remarks.
1838	Feet	Feet	Feet	
December 3 at 7 A. M.	32,27	390	31,99	
8 ,,	31,31	367	31,75	
9 ,,	31,31	367	31,03	
D. H. M. 10 ,,	31,07	361	31,75	* The disturbed state of the sky and sea renders the observations of this day less satisfactory.
(O Decr. 1 4 55) 11 ,,	31;43	401	31,99	
12 ,,	31,90	411	32,47	
1 P. M.	32,99	397	33,30	
2 ,,	33,71	413	33,67	
3 ,,	34,19	421	33,91	
4 ,,	33,71	449	33,43	
5 ,,	32,99	397	32,71	
Mean	32,44		32,54	feet Mean=32,49
Maximum	34,19	449	33,91	
Minimum	31,07	367	31,03	
Difference	3,12		2,88	Mean 3,00
Approximate time of high water	h. m. 9 30	h. m. 9 0	h. m. or mean=9 15	

☽ culminates inf. 13 37

High water bef. ☽ culminates 4 22

Collecting these several results it appears that the amount of tide experienced at Madras, is

Amount of tide.	F. I.	High water. H. M.
At the new and full moon	2 10	4 26 bef. ☽ culminates.
At the quarters............	1 9	

The above observations and results are the best under the circumstances attending them that I have been able to obtain ; in addition to these I have but little to state, and that little being more the result of casual than precise observation, of course is entitled to proportionally less credit. To sum up the whole, it appears that, on an average of 40 years, the north-east monsoon sets in on the 19th day of October, being very rarely as much as 10 days earlier or later ; and that, although the north-east wind continues generally until the middle of February, still the force of its effect seldom extends beyond the 10th of December. It further appears that commencing with the N. E. wind, a current of variable velocity sets in from the north, in a direction parallel with the shore; and that it generally increases in strength in the course of the day, and decreases during the night,* and is moreover influenced by the strength of the wind; the current appears to reach its maximum velocity about the 1st of November, when in conjunction with the tide it amounts to three miles per hour; and from this time decreases until the 10th of December, when it amounts to a small fraction of a mile per hour only. During this interval, the sea, upon a squally day—such as it would be dangerous if not impossible for boats to go off on,—may be stated to rise two and a half feet above, and to sink as much below, its mean level :—and in the case of a gale of wind it may possibly reach to the double of this amount.

Varying with the run of the sea is the height of the surf, and the distance from the shore at which the outer surf breaks ; being modified however by the wind and current. In a squally day, such as would be dangerous to catamarams or boats, the outer surf breaks at a distance of 400 feet from the shore, and in the case of a gale of wind,† the surf broke on the outside of the nearest buoy (which is 828 feet from the shore‡) : but on occasions of this nature the swell, breakers, and surf

* This remark although not invariably confirmed by the foregoing observations, is nevertheless I believe generally true : the catamaram men and boat men state that the current is always stronger in the afternoon than in the morning

† The very high surf experienced on the 6th December, although not resulting from a gale of wind at Madras, evidently had its origin in one at no great distance.

‡ I was not at the beach on this day ; but from the testimony of the Master Attendant and his deputy there can be but little doubt of this statement being correct.

merge the one into the other, so as to render it difficult to decide at what point the surf first breaks. The particulars with regard to the tides (already given at the beginning of the last page) differ in some respects from those found some years ago by Col. De Havilland: it is probable, however, that his observations were not made during the north-east monsoon, to which the results here given particularly belong.

Madras, 19*th December*, 1838.

N. B.—The above elevations of the *Station* above the level of the sea with the 5 feet telescope, have for the sake of comparison been reduced to the same elevation as those of the theodolite—we have—

	F.	I.
Elevation of theodolite station above mean level of the sea	32	4
——————above the floor of the verandah	5	1
Floor of verandah above mean level of sea	27	3

VII.—*The comparative cheapness of Large and Small arched Bridges.*

To the Editor of the Madras Journal of Literature and Science.

Dear Sir,—It is some time since we heard that Government was going to construct a work of vast public utility near Trichinopoly, namely a permanent bridge across the river Cauvery, and it is now rumoured that the Court of Directors have liberally sanctioned this beneficial undertaking; and determined, as the most economical mode of construction, that it shall consist of 40 small arches.

Now as I feel rather sceptical whether this notion of economy is correct, and it would be a pity to see a work of this kind constructed without regard to appearance, if nothing is gained by the neglect, I have determined to submit the question of the comparative cheapness of large and small arched bridges, to the learned among your readers; in hopes, if I am wrong, of having my doubts removed; or, if I am right, of conferring a benefit on our Trichinopoly public by promoting the better ornamenting of the town.

There are two ways in which people commonly talk of bridges; either as an artificial platform, from one side of a river to the other, which is cheap in proportion as it is thin; or as a road-way, supported by piers,

and less costly, as it has fewer of these piers. In these summaries the first position only seems to deserve investigation; for, if I am rightly informed, the difference in the amount of materials in the two cases, varies only as the span of the arch, and is not affected at all, by the number of piers; that is, the strength of the piers may be regulated in direct proportion to the span of arch; if the span be double, the piers too must be twice as thick; so that in the whole length of the bridge, the solid dimensions of the pier work are equal, whatever be the distance apart; but on the other hand, wider arches must be thicker than narrow, or they will not stand.

Architects tell us, that a bridge arch (of any but the very smallest dimensions), is not safe, unless it have at least one and a half feet of thickness at the apex, and it seems to be further agreed, that this thickness is sufficient for a span of 36 feet; all smaller arches therefore would seem to involve a waste of strength, or have a thicker platform than is required, and therefore they ought not to be built.

In proportion as this limit is exceeded, it appears, then, that the platform must be thickened, whilst the piers must also be augmented, as before described, in such a ratio, as to make the total of their thickness, just what it would be, if the spans were no more than 36 feet; we may therefore conclude that a brick bridge contains the smallest possible quantity of materials compatible with strength, if its arches have a span of 36 feet: but is it therefore less expensive?

To determine this, keeping out of sight for the present the question of risk from more impeded water-way, the following propositions should be solved: namely, whether, two piers, say of 6 feet, can be built for the same money as one of 12 feet; whether the difficulty and consequent liability to error is increased or diminished by multiplying the works in the bed of a river; whether (remembering that bricklayers are paid by the day and not by the quantity of work done) we are to suppose that more or fewer tiers of arch-work will be laid in the same time, each series requiring a fresh adjustment, by having fewer or more angles of direction to consult for the joints; whether (all arches being considered works of skill), the likelihood of individual or partial failure is diminished or increased by the numerical amount of such works of skill; whether a sinking of the piers is more to be anticipated when the foundations are many and narrow, or few and broad; whether danger of unequal subsidence of the arches is greater or less, as there are many or few arches to subside; and, lastly, whether all these sources of error and hindrances to the workmen would not in the end render the many arched bridge a work costing more money than one, more nearly ap-

proaching the dimensions which are now usually adopted in Europe: I will end my queries by asking whether I am still entitled to subscribe myself,

A non contributing reader ?

AMICO-PONTICULUS.

TRICHINOPOLY, 5th *August*, 1838.

VIII.—*A remarkable Appearance in the Indian Seas; in a Letter from Lieutenant* DAWSON. *Communicated by* WILLIAM NEWNHAM, ESQ.

I beg leave to lay before the meeting an extract from the private journal of Lieutenant Henry Dawson, a very intelligent officer of the Royal Navy, at present employed on civil duties with the Indian Navy at Bombay, containing an account of a very extraordinary phenomenon, which was observed on the passage from Bombay to the Persian Gulf (the southern passage), on board the Honourable Company's sloop of war Clive, in 1832. On my first going to India, I was in the habit of intimacy with the late Captain David Seton, who was many years resident at Muscat, and I well remember hearing him relate the circumstance of falling in with the *white sea*, described by Mr. Dawson, on his occasional voyages to Muscat, during the period of the south-west monsoon.* So many years, however, have since elapsed, I am unable to give any more detail of the circumstance related by that officer, and merely here allude to it in proof of the phenomenon having been before observed.

WILLIAM NEWNHAM.

During a passage from Bombay to the Persian Gulf, on board the Honourable Company's sloop Clive, on the 22nd of August, 1832, at a quarter before eight o'clock at night, a phenomenon appeared of the following nature, and to all on board, of an unheard-of-kind, which gave

* Our subsequent inquiries serve to confirm this statement, inasmuch as few navigators appear to have passed along the eastern coast of Arabia, in the months of June, July, and August, without noticing the discolourment of the water (but *during the night only)*, and which, on examination when brought on board, is said to exhibit no difference whatever from sea-water in other parts of the ocean.—ED. *Jour. R. A. S.*

rise to transitory feelings of apprehension as to the vessel's contiguity to danger. Sailing under double-reefed top-sails and foresail, at the rate of nine and a half miles per hour, before a strong south-west monsoon wind, and a high sea, without any indication of a change in the elements, the ship was surrounded *instanter* by water as white as milk or snow; it seemed to have no termination until it reached an altitude of seventy-five or eighty degrees, where it subsided in a strongly marked ecliptic, above which the heavens presented a beautiful and bright blueish cast, not dissimilar to polished steel. No line of horizon was visible; the dead white colour of the water close to the ship, as it increased in distance from her very gradually brightened, until, where I supposed the horizon to be, it assumed a silvery aspect, which, increasing as it ascended, became brilliant and dazzling towards the zenith, obscuring the stars and clouds which had before this visitation been distinctly visible. The sea in a moment became smooth; the ship, from rolling and labouring considerably, quite steady; no diminution in the wind occurred, but a sensation that it had fallen, even to a calm, was general, but momentary. This delusion was occasioned by the instantaneous steadiness of the vessel, as well as the cessation of the previous noise from the lashing of a mountainous and confused sea against the vessel's sides, and on her decks; her progress through the sea, however closely scrutinised, could not be observed; the disturbed water alongside and in her wake, as well as the foam around her bows, did not contrast with the adjoining unagitated fluid, notwithstanding, from the velocity of the ship through the water, these must have been considerable. Not a particle of phosphoric matter was once observable, either in the surrounding ocean, or in the water immediately displaced by the ship's passage through it; but when taken up in a bucket, and agitated with the hand, such was visible, but not in a greater proportion then is usual, nor did the water vary in appearance from common sea-water: nothing could be perceived to attribute this strange phenomenon to.

Animalcules of a minute kind were perceptible, as likewise a few pieces of a glutinous substance of a purple colour, but neither in any considerable quantity, nor differing from what is usually found in the seas of the Indian Ocean.

We sailed the distance of fifteen miles without the slightest change in the appearance of the sea or sky, when in a moment this extraordinary phenomenon vanished, the ship at the same instant encountering the like high and turbulent sea as previous to her envelopement.

The ship was not within one hundred miles of the eastern coast of Arabia, or of soundings, but sailing in what is termed deep ocean water.

I have before mentioned that the ship was quite steady during her progress through the white water: this was the case, with the exception, that in a few instances she gave a heavy roll, as if influenced by a following swell; these were not more frequent than once in a quarter of an hour. Latitude 21° 40′ north, 59° 40′ east; thermometer 87°, barometer twenty-nine inches and nine-tenths.

The phenomenon I have attempted to describe appeared twice after we were first extricated from it, for periods of about twenty minutes; its brilliancy, as well as influence over the waves, as previously described; the transition from high and mountainous seas to a smooth and seemingly quiet ocean, and change again to turbulence, was as sudden as a flash of lightning.

On my arrival at Muscat, a few days after, I endeavoured to gain some information on the foregoing matter, but beyond finding that the phenomenon was occasionally met during the strength of the south-west monsoon, about the limit noted, and that the water was then *quite fresh*, I could ascertain nothing satisfactory. My informants were the Nakodas, or captains of His Highness the Imam's ships of war, who frequently navigate between Muscat and Zanzibar, consequently must pass about the spot the Clive met what I have related. The Arab captains were firm in their assertion in the particular of the fresh water, although they confessed that they had never tasted it. I did, as also the surgeon of the vessel, and, as I mentioned before, it did not vary in any way from ordinary sea-water.—*Journal of the Royal Asiatic Society*, No. 9—p. 198-200.

H. D.

IX.—*Special Report on the Statistics of the Four Collectorates of Dukhun, under the British Government.*

[In spelling Oriental words, the *a* is the *a* in *all*, the *u* as in *hut*; the rest have the usual English sound.]

The General Committee of the British Association which met at Cambridge in 1833, did me the honour to pass a resolution that I should prepare for publication my manuscripts respecting the Statistics of Dukhun (Deccan). I have been anxious to respond to so flattering a desire at an earlier period, but having placed my manuscripts in the hands of a distinguished person, as auxiliary to his scientific labours, I have been

deterred from reclaiming them until the objects for which they had been placed at his disposal were realized.

In responding at last to the call of the British Association, I feel very considerable embarrassment in adapting my materials to the space which can be afforded to me in its annual volume. The materials, in fact, are very voluminous; and the nature of my subject embracing multitudinous details, figured statements, and lengthened tables, makes it a work of no ordinary difficulty to digest, abridge, and condense them without involving my subject in obscurity, and exposing myself to the imputation of inefficient inquiry from the hiatus which must appear. I beg, therefore, distinctly to state, that the absence of information observable in the following Report, is attributable, not to paucity of matter, but to the want of a sufficient field in which to display it.

Extent and Physical Circumstances.

I propose to give but a meagre sketch of the statistics of Dukhun; a mere enumeration of its population, products, manufactures, revenues, civil divisions, &c., with little more comment than may be necessary to ensure perspicuity.

In the execution of my public duties as Statistical Reporter to the government of Bombay, my researches made me acquainted with the statistics of the four collectorates of Dukhun, denominated the Poona, Ahmednuggur, Candeish or Khandesh, and Dharwar Collectorates; facts were also collected respecting the territories of the Rajah of Sattarah, and some few details came to hand illustrative of the state of the possessions of the southern Mahratta Jagheerdars, which are under British protection. In adverting to the whole of these territories, although I shall name them separately in describing their extent, physical circumstances, and civil divisions, it will only be to notice where they differ from each other.

The whole of the above territories, containing 3,285,985 inhabitants, spread over 48,987 square miles, and averaging 67 inhabitants to the square mile, lie upon that elevated plateau, which has an abrupt termination on the western side of India, in what are usually denominated the Ghàts, but which plateau gradually declines, occasionally by a succession of low steps, as is seen by the courses of rivers to the Coromandel coast, excepting in Khandesh (Khind meaning a gap or trench, and Desh a country), where the river Tapty disembogues to the westward, from the peculiar configuration of the narrow valley in which this collectorate lies. Some of the platforms on the summit of the Ghàts have an elevation of 5000 feet above the sea, but the general level of the

main plateau of Dukhun is about 2000 feet high near the Ghàts, and scarcely exceeds 1000 feet in the eastern limits of the collectorates. The whole territory is mountainous near to the Ghàts, and has numerous valleys, some of them narrow and tortuous, others broad, open, and flat. At from thirty to fifty miles eastward from the Ghàts, most of the mountain spurs which produce the valleys terminate, and the country becomes open and tolerably level for considerable distances, with an occasional step down to the eastward; the country, in fact, being made up of beds of trap, the beds extending the further to the eastward the lower they are in the series. There is much forest and underwood and jungle along the line of the Ghàts; but to the eastward the country is open, and there is a want of wood; parts of Khandesh and Dharwar are exceptions to this description. The western tracts along the Ghàts are called the Mawuls, in contradistinction to the open country, which is called the Desh or Dès.

It may be as well to state here that all lands in Dukhun are classed within some village boundary or other, and this boundary is maintained with such jealousy and tenacity by the inhabitants, as to lead to frequent feuds and bloodshed on the slightest invasion of village rights. The village constitution and the occupancy of lands will be mentioned under land-tenures.

Rivers.—The rivers of Dukhun, which in the monsoon flow with a magnificent volume of water, in the hot season present a broad gravelly bed, with only a thread-like stream in many of them, but from natural barriers of rock in the bed of the Beema, Godavery, Kistnah, and other large rivers of Dukhun, extensive sheets of water, called Dho or Dhao, are formed, which abound with fish.

Roads and Bridges.—The roads in Dukhun, with the exception of two great military roads, are untouched by art; and few of the rivers can boast of a bridge.*

Climate.

A detailed account of the atmospheric tides, and meteorology of Dukhun having been published in the *Philosophical Transactions*, I shall limit myself to a description of such broad features as characterize the climate. The Ghàts and the Desh have distinct features. The tract along the line of the former has a lower mean temperature, much more

* The *Geology of the Deccan*, which follows in this place, was re-published by us from the *Transactions of the Geological Society of London*, in the 17th Number of this Journal, p. 344.—Editor, *Madras Journal.*

moisture, greater prevalence of westerly winds, a more limited range of the thermometer; but a greater prevalence of fogs before, during, and after the rains, but not in the winter months; and, finally, is characterized by the absence of hot winds. The Desh, on the contrary, has the air excessively dry in the hot months; a great diurnal and annual range of the thermometer, a comparatively small fall of rain in the monsoon, the frequent occurrence of hot winds, and the rareness of fogs.

Barometer.—The mean monthly pressure of the atmosphere is greatest in the winter months of December and January; it gradually diminishes until July or August, the most damp months, when it is at its minimum; it gradually increases again until the cold months. The greatest diurnal oscillation recorded by me in several years' observations was ·1950, or less than two-tenths of an inch; the smallest oscillation ·0150. The mean rise of the barometer from sunrise to 9—10 A. M. for three years was ·0445, thermometer + 7°·15′. The mean fall from 9—10 A. M. to 4—5 P. M., for four years, was ·1066, thermometer + 5°·21′; and the mean rise from 4—5 A. M. to 10—11 P. M., for one year, is ·0884, thermometer —7°·2′. The maximum range of the barometer at Poona, in the year 1830, at 1823 feet above the sea, was only ·672, or not seven-tenths of an inch. The mean height of the barometer for that year was 27°·9254, and the mean height in the monsoon was 27°·8447; so that the constant moisture of the monsoon only occasioned a mean diminution of pressure of ·0807, or less than one-tenth of an inch. At Madras, for twenty-one years, the mean height of the barometer was 29°·958′ inches; at Calcutta, the means of three years make it 29·764. M. Arago, at Paris, by nine years' observations, reduced to the level of the sea, makes the mean height 29·9546 inches, being almost identical with the mean height at Madras.

Atmospheric tides.—There are four tides of the atmosphere in Dukhun, as indicated by the movement of the barometer; two diurnal, and two nocturnal: the diurnal rising tide is from 4—5 A. M. to 9—10 A. M., and varies from ·0200 inches to ·0500 inches; the falling tide is from 9—10 A. M. to 4—5 P. M., and varies from ·1950 inches to ·0150 inches. The nocturnal rising tide is from 4—5 P. M. to 10—11 P. M., and varies from ·0450 inches to ·1140 inches; the nocturnal falling tide is from 10—11 P. M. to 4—5 A. M., and is about ·0442 inches. This order was never deranged or inverted in one single instance in many thousand observations.

Temperature.—The climate of Dukhun is subject to very considerable variations of temperature; more, however, in the diurnal than in the monthly or annual ranges; indeed, less so in the last particular than in Europe. In 1827, the extreme range of the thermometer at Edmonton

was 75° Fahrenheit; at Cheltenham, 64°·6. In St. Petersburgh, the thermometer has been as low as 35°·7′ below zero, and as high as 91°·4; the range, therefore, 127°·1. At Berne, the annual range has been more than 75°. In 1826, I observed a range of 53°·4, viz., from 93°·9 on the 12th March, to 40°·50 on the 15th January at sunrise. In 1827, the maximum range observed by me was 48°·8, viz., from 96°·8 on the 28th March, to 48° on the 12th December at sunrise. In 1828, the maximum occurred on the 7th May, being 101°, and the minimum was 56°, the range, therefore, 45°; but, for a very short time, the thermometer rose on the 7th May, between two and three o'clock, to 105°; and this was the more remarkable as I was then encamped on the edge of the Ghàts at the source of the Beema river, at an elevation of 3090 feet above the level of the sea. This instance of unusual height of the thermometer, however, is not confined to Dukhun, for we learn from M. Arago, that it has been higher than 101° Fahrenheit in the shade in Paris.

Monthly means.—The monthly *means* do not differ more than from 13° to 17° from each other. In 1826, the difference between the hottest month (May, 83°·28), and the coldest (January, 65° 90), was only 17°·38. And in 1829, March was the hottest month, and November the coldest, their difference of means being 13°·66.

Diurnal range.—The greatest diurnal range in 1826 was on the 5th March, being 37°·30, from 50°·5 to 87°·8. In 1827, it was 39°·5, on the 12th December, from 49°·5 to 89°. In 1828, it was 34°·8, on the 16th July, from 56° to 90°·8. In 1829, the maximum diurnal range was 37°·5 in December. The minimum diurnal range occurs in the monsoon months of June, July, August, and September; indeed, occasionally, on some days in those months, the mercury does not move at all.

Mean Temperature.—In 1828, Dr. Walker, at Ahmednuggur, at an elevation of 1900 feet above the sea, made the mean temperature 78°; and though I was living in tents, and moving about the country, I made it only 77°·93. Of course, on higher or lower levels this mean temperature will be diminished or increased. It is necessary, however, to note one remarkable fact, namely, that the mean temperature of places on the table-land of the continent of India is much higher than the calculated mean temperature of the *same* places agreeably to Mayer's formula. The calculated mean temperature of Ahmednuggur is 72°·27, observed 78°; of Poona 72°·78, observed 77°·7; of Mhow, in Malwa, 69°·86, observed 74°: temperature of a spring in the hill fort of Hurreechundurghur 69°·5, calculated temperature 65°·45.

The results of several years' observations indicate that the annual mean temperature of 9°·30 A. M., is nearly identical with the mean temperature deduced from the maxima and the minima.

With respect to the greatest diurnal, and the greatest monthly range of the thermometer, the winter months have a range nearly in a quadruple ratio to the monsoon months. The latter have mostly the temperature very equable, the difference of the monthly means rarely exceeding 3°, and the greatest diurnal range in five years only once amounted to 13°·6. The latter end of March, and April, and May are the hottest periods of the year, from the position of a nearly vertical sun, the intensity of whose influence is but slightly modified by the occasionally cloudy weather: the temperature falls in June, and continues nearly stationary until the end of September: it then rises in October, but falls at the end of the month, until its annual minimum in December or January. It is low the early part of March, but rises *suddenly* after the middle of the month, occasioning a difference of 6° or 8° between the means of February and March, which is more than double that of other consecutive months in the year. The rise in October is also sudden, but does not occasion so great a difference of means as between February and March. It will thus be remarked that the temperature does not follow the sun's declination, owing to the interference of the monsoon.

Moisture.—A remarkable feature in the climate of Dukhun is the small quantity of aqueous vapour generally suspended in the air, compared with the proximate climate of Bombay and the coast, or even the hilly tracts of the Ghàts. My observations were made with Daniell's hygrometer, and extended over several years. There is a gradual increase of moisture in a cubic foot of air, from the most dry month, February, until June and July. Hence the moisture remains nearly stationary until the beginning of October, when it diminishes somewhat rapidly and regularly until February. The annual mean dewing point is greater at 9½ A. M. than at sunrise or at 4 P. M., but this does not uniformly hold good in each month of the year. In 1826, the highest dewing point was at four o'clock on the 21st October, being 76°·, temperature of the air 84°·5, a cubic foot of air holding 9·945 grains of water. The lowest dewing point was on the 4th December, at sunrise, being 44°, temperature of the air 56°, a cubic foot of air containing 3·673 grains of aqueous vapour; but the lowest dewing point did not indicate the driest state of the atmosphere, as a dewing point of 45° in November, with a temperature of 87° at 4 P. M., gave only 3·587 grains.

The most moist month was July; the mean weight of water in a cubic foot of air was 8·775 grains, and the point of saturation was only 4°·85 from the dewing point. The greatest monthly range of the dewing point was, in October, 30°, and the smallest range, 7°, was in July and August. The monthly range was not coincident with the movements of

the barometer and thermometer; but there were curious approximations. The extreme dewing points differed 32°. The dewing point has been as high as 76°, temperature of the air 79°, a cubic foot of air containing 10·049 grains of aqueous vapour; but this is a rare occurrence. An instance occurred of the dewing point being obtained at 3° below the point of the congelation of water, the temperature of the air being 62°, and a cubic foot of air holding 2·146 grains of water. There is also an instance of a dewing point, in February, 1828, being 61° below the temperature of the air, viz., from 90° to 29°, but I never afterwards succeeded in determining anything like so great a depression.

In January, 1827, there was a range of the dewing point of 38°, and the extreme range of the year was 47°, viz., from 29°, temperature 62°, in January, to 76°, temperature 79°, in June. In 1829, the mean dewing point for the monsoon was 69°·62, temperature 75°·83; the cubic foot of air containing 8·191 grains of water. In 1830, the observations are only complete for 9—10 A. M.; the mean dewing point was 61°·9, temperature 78°·4, and a cubic foot of air contained 6·351 grains of water; the extreme range of the hygrometer was 47°, the lowest dewing point 31°, temperature 50°, in December. It might be supposed that the hottest months in the year, March, April, and May, would also be the driest; but such is not the fact. The powerful action of the sun on the ocean, in the middle of March, raises a large quantity of aqueous vapour, which continues to increase in the ratio of the sun's progress north: the westerly winds waft this vapour into Dukhun; much of it is arrested by the Ghàts and hilly tracts eastward of these mountains; accounting for the sensible moistness of the air, the frequent night fogs, and deposition of dew in this line, in the end of March, and in all April and May. The supply of moisture diminishes in proportion to the distance eastward from the sea, to the limits of the Coromandel coast monsoon. We in consequence find the Ghàts, Poona, Ahmednuggur, and the Bala Ghàt, all with very different dewing points in the hot months.

The hygrometric state of the air in Bombay and Dukhun is remarkably contrasted: in fact, there is more aqueous vapour suspended in the air in Bombay in the hot months, than there is at Poona at any time during the monsoon. In April and May, 1826, in Bombay, the monthly mean dewing points were respectively 72°·84 and 75°·59, temperature 83°·48 and 84°·52, a cubic foot of air holding 8·988 grains, and 9·743 grains of water suspended; whilst July, the most rainy month during the monsoon, at Poona, had only a mean of 8·775 grains of water suspended. In 1827, the means of ten days' observations in Bombay, in April, gave 10·243 grains of aqueous vapour in a cubic foot of air; and

the greatest mean quantity at Poona was in June, and it amounted only to 8·931 grains. In 1828, in the month of March, the following were the dewing points in consecutive days, travelling from Bombay to Poona: Bombay, 10th March, 4 P. M., 11·205 grains of water in a cubic foot of air; at Poona, at the same hour, on the 14th March, 2·273 grains. At Bombay, on the 10th, at sunrise, and at 9½ A. M., the dewing points were respectively 72° and 71°, temperature 75° and 81°·5, a cubic foot of air containing 8·873 grains at the former hour, and 8·487 grains at the latter hour. The following morning at Kundallah, on the top of the Ghàts, 1744 feet above the sea, at the same hours, the dewing points were 36° and 40°, temperature 72° and 78°, equivalent only to 2·690 grains, and 3·004 grains of water in a cubic foot of air. In the afternoon of the same day, at Karleh, 2015 feet above the sea, seven miles east of Kundallah, a cubic foot of air held 2·954 grains, and on the 12th, at 4 P. M., 2·611 grains of aqueous vapour. On the summit of the hill fort of Loghur, 3381 feet above the sea, and 1366 above Karleh, the dewing point at sunrise on the 13th, was 5° Fahr. below the freezing point, temperature of the air 67°, and a cubic foot of air held only 1·995 grains of water in a state of vapour. These facts fully establish the remarkable discrepancies between the hygrometric state of the air in Bombay and Dukhun, and that too within a difference of a few miles of latitude and longitude. A comparison of the absolute falls of rain in Bombay and in Poona, for the years 8826-7-8, shows an agreement (to a certain extent) in their ratio to the hygrometric state of the air at Poona and Bombay, above noticed. The mean fall of rain at Bombay in those years was 93·62 inches, and at Poona 26·926 inches, or 28¾ per cent. only of the fall in Bombay.

Rain.—In Dukhun the rains are light, uncertain, and, in all years, barely sufficient for the wants of the husbandman, and a slight failure occasions much distress. They usually commence at the end of May, with some heavy thunder showers from E. to S. E., the lightning being terrific and frequently fatal, and the wind furious; but they do not set in regularly until the first ten days in June, and continue until the end of September from the W. to the S. W., and break up with thunder-storms from the E. to the S. E. before the middle of October. During the remaining months of the year an accidental shower or two may fall from the Coromandel monsoon; and the further the distance eastward from Poona, the greater the chance of showers in the cold months. The monsoon temperature is equable and agreeable, and the rain occurs almost always in showers, rarely continuing uninterruptedly for a day or more, as is common on the coast and in the Konkun. The greatest

quantity of rain falls in the months of June and July. The greatest fall of rain in any one day was 2·58 inches, on the 6th July, 1826; at Bombay, on the 24th June, 1828, there fell 8·67 inches; and at Hurnee, on the 15th June, 1829, there fell 8·133 inches in 24 hours.

The mean annual fall of rain for all England, from many years' observations, appears to be 32·2 inches, but the means of different counties vary from 67 inches in Cumberland to 19 inches in Essex.

The clouds supplying the monsoon rains in Dukhun would appear to have a low elevation, as I have frequently seen through breaks as they were passing swiftly from west to east, a superior stratum, apparently stationary, or moving slowly in a contrary direction, and gilded by the sun's rays.

Winds.—The great features in the observations respecting the winds, are the prevalence of winds from the west and westerly quarters, east and easterly quarters, and the extreme rareness of winds from the north and south, and the points approximating to them; and these features appear to be constant in successive years. In 5229 observations the wind blew from the west, or points adjoining, 2409 times; and in this number the S. W. (305), and N. W. (122), amount only to 427. From easterly points 949 times, including 246 from the N. E. and S. E., thus leaving 703 from the east. From the north 115 times, and from the south 36 times only. Another feature is the frequent absence of wind, particularly at sunrise, and more so in the months of January, February, March, October, and November than in other months of the year. The cessation of wind from May to September inclusive is comparatively rare; and, generally, throughout the year the absence of wind at 4 P. M., may be looked upon as unusual. In my records there are 1720 observations of "*No* wind," and 847 of these belong to sunrise, 452 to 9—10 A. M., and 304 only to 4 P. M.

The observations were continued through five years, three times daily; sunrise, 9—10 A. M., and 4 P. M. There is considerable uniformity in the direction of the wind in the same months in consecutive years. The westerly winds begin to *prevail* in March, alternating with easterly winds, which blow the latter part of the night; but the easterly winds disappear as the monsoon approaches, and do not re-appear again till October. In October the winds are variable, and the records of "No wind," increase suddenly and rapidly. A few easterly winds, however, about the end of the month, indicate the change which is to take place; they gradually increase, and with those from the N. E. and S. E., almost entirely supersede the winds from the westerly points during the cold months.

In March, from the sun's approach, the interior land during the day gets heated; an influx of air from the sea coast commences daily after 10 A. M.; but as the earth, at this period, cools more rapidly than the sea at night, the interior is cooler than the coasts, and there is a reflux of air towards the ocean; the easterly and westerly winds thus alternate day and night. This alternation, however, diminishes in the ratio of the sun's increasing power; and when the earth gets so thoroughly heated that it cannot reduce its temperature by radiation below that of the sea, the consequence is the prevalence of winds from the westerly points to the almost entire exclusion of those from easterly points. In June the westerly winds set in regularly. There are occasional instances of the wind blowing with much steady violence from the west for many hours in the hot months with a sunny sky. In the early part of March some unaccountably cold winds, affecting vegetation even, have been known to blow.

Hot Winds.—The well-known hot winds of tropical continents do not prevail near the Ghàts; but the same wind, which is pleasant in their neighbourhood, may become a hot wind as it travels to Ahmednuggur and Arungabad. The east wind is characterized by its extreme dryness, and it is dangerous to sleep exposed to it.

Whirlwinds.—Those curious whirlwinds noticed by travellers in Africa, and which in the deserts are dangerous, are of common occurrence in Dukhun in the hot months. A score or more columns of dust, in the form of a speaking trumpet or water-spout, may be seen rapidly coursing over the treeless plains, marking a vortex of heated air. They are sufficiently powerful to unroof a thatched house, strike tents, and whisk away all light matters.

Hail Stones.—Hail stones of considerable magnitude sometimes fall in the thunder-storms of the hot months.

Dews.—Dews appear plentifully after the monsoon, and during the nights of the cold months; but their frequent local occurrence has often excited surprise.

Fogs.—Fogs are of so rare occurrence in the Desh, or country eastward of the Ghàts, that I have only nineteen records of them during five years. Along the Ghàts they are much more common; and during April and May, for three or four nights in the week, fogs drift rapidly to the eastward from the Konkun, or low country at the foot of the Ghàts. On some nights no drift takes place, and the fog remains resting on the Konkun; and, seen from the crest of the Ghàts at sunrise, has the appearance of a sea of milk. As the sun rises the fog creeps up the chasms of the Ghàts, and finally disappears by 10 A. M.

Salubrity of the Climate.—With respect to the salubrity of the open parts of the country, it will only be necessary to state that, in my little camp, consisting of more than a hundred souls (natives), I had not a single death of an adult during 6 years; nor a case of illness (excepting one) that I did not cure without regular medical aid. Dr. Walker, long civil surgeon in the city of Ahmednuggur, found the casualties in 1828 in that city (exclusive of losses from spasmodic cholera) to be only 1·82 per cent., or 1 in 55·1 persons; and, including cholera, 2·48 per cent., or 1 in 40·2 persons. Dr. Lawrence, in charge of a regiment of natives 1,000 strong, lost only 0·85 parts of an integer per cent., per annum, or about 5 men in 600 during the years the regiment was in Dukhun.

Parts of Khandesh have not credit from the same salubrity.

Botany.

Under this head I shall confine myself to a simple enumeration of the agricultural and garden products, and wild fruits. To enter into the botany of Dukhun generally would be misplaced in this digest. And first with regard to cultivated native fruits; there are forty-five in number, viz.

Cultivated Fruits.—Amba, *Mangifera indica* [a]; Oombur, *Ficus glomerata*; Phunnus, *Artocarpus integrifolia* [b]; Cheents, *Tamarindus indica* [c]; Ambarra, *spondias Mangifera* [d]; Hurparewree, *Cicca disticha*; Ramphal, *Annona reticulata* [e]; Seetaphul, *Annona squamosa*; Raeebor, *Zizyphus jujuba*; Jamblee, *Calyptranthes caryophyllifolia*; Awlee, *Phyllanthus emblica*; Bail, *Ægle Marmelos* [f]; Wowulee, *Mimusops elengi*; Narlee, *Cocos nucifera* [g]; Jamb, *Eugenia Jambos* [h]; Mohha, *Bassia latifolia*; Toot, *Morus alba* [i]; Shatoot, *Morus indica* [k]; Choonchoo, *Morus*——— [l]; Kurumbul, *Averrhoa Carambola* [m]; Kuweet, *Feronia elephantum* [n]; Bhokur, *Cordia latifolia*; Anjeer, *Ficus Carica* [o]; Daleemb, *Punica granatum*, (two kinds) [p]; Weer, *Citrus limon* [q]; Chukotur, *Citrus decumanus* [r]; Maloong, *Citrus medica* [s]; Nareeng, *Citrus aurantium* [t]; of these there are several kinds; Ambut neemboo, *Citrus acida* [u]; Sakur neemboo, *Citrus limon* var. [x]; Peroo, *Psidium Pyriferum* [y]; Peroo tambra, Red Guava; Kajoo, *Anacardium occiden-*

a Mango.
b Jack fruit.
c Tamarind.
d Hog-plum.
e Sweep-sop.
f Bengal quince.
g Cocoa nut.
h Rose apple.
i White mulberry.
k Red mulberry.
l Small mulberry.
m Coun. gooseberry
n Wood apple.
o The garden fig.
p Pomegranate.
q Lemon.
r Shadock.
s Citron.
t Orange.
u Lime.
x Sweet lime.
y Guava.

tale [a]; Gondnea, *Cordia myxa;* Tarh, *Borassus flabelliformis;* Phopy, *Pupeea Carica;* Badam, *Terminalia catappa;* Sooparee, *Areca faufel* [b]; Kujoor, *Phœnix dactilifera* [c]; Kel or Kail, *Musa paradisiaca* [d], there are several species or varieties. Sonkel, *Musa sapientum;* Draxhs, *Vitis Vinifera* [e]. There are seven species of grapes in Dukhun, the Mahratta names of which are Kalee, or black; Ahbee, or watery; Phukree, or Muscadina; Saheebee, Bedana, or seedless; Sooltanee; and Suckree, or sugary. Khurbooz, *Cucumis Melo* [f]; Phoot, *Cucumis momordica;* and Kulungrah, *Cucurbita Citrullus* [g]. There are several species or varieties of the melon.

Wild Fruits.—The wild fruits are twenty-two in number, viz. Beebah, *Semicarpus anacardium* [h]; Cher, *Chirongia sapida;* Ratambee, *Garcinia*——— [i]; Torun, *Zizyphus albens;* Kurwund, *Carissa Carandas* and *diffusa*, both of them excellent fruits; Seendee, *Phœnix Sylvestris*, or *Elate Sylvestris* [j]; Jungle Jaeephul, *Myristica dactyloides* [k]; Peempree, *Ficus comosa;* Rahbor, *Zizyphus Xylopyrus*; Bunkeil, *Musa troglodytarum*, [l] two varieties; Gooloom, *Loranthus bicolor;* Lotowl, a genus and species not determined; Ambgoolee, *Elæagnus*———, a very nice fruit, tasting like a gooseberry. Ulloo, *Vanqueria spinosa;* Temboornee, *Gardenia*, ——— ; Thurtee, *Capparis erythrocarpus*; Neptee, *Capparis aphylla;* Wagatee, *Capparis Zeylanica;* Makur Neembonee, *Citrus*——— [m]; Wuhr, *Ficus Indica;* Loheer, *Ficus*———, a noble tree, 80 to 100 feet high.

The above comprise the wild fruits of Dukhun; many of them are not only passable, but very palatable, particularly the Ambgoolee, the Kurwund, and the Char. The Ratambee, or wild mangostein, is in extensive use as an acid seasoner, and is met with for sale in most markets in a dried state. The wild nutmeg is frequently imposed upon the ignorant for the real nutmeg. The oil of the Beebah is used for marking linen, like indelible ink; but the kernel roasted is agreeable. The wild lime *(Citrus)* is only met with in the Ghàts; it forms a handsome dense tree, but the cultivated fruit is so abundant that the wild is not made any use of. Many of the above fruit trees produce good timber. With respect to the mango, which is met with both cultivated and wild, it is considered by the people less as a luxury, than as an auxiliary to the necessaries of life, or as a substitute for them in seasons of scarcity; for the

a Cashew nut. b Beetle nut. c Date. d Plantain. e Grapes. f Musk melon. g Water melon. h The marking nut. i The wild mangostein j Wild date. k Wild nutmeg, l Wild plantain. m The original apparently of some of the species of *Citrus* in Dukhun.

mango is in fruit, and seldom fails an abundant crop, at a time when the earth is parched up by the heats of May and beginning of June.

Agricultural Products.—A brief notice only of the agricultural products can be given. The harvests are of two distinct kinds; one is the Khurreef, or rainy season harvest; the other is the Rubee, or dry, or cold, or spring season, harvest.

Wet Season Harvest.—This harvest produces twenty-two kinds of grain and pulse; but the products of the Desh, or open country, are different from those of the Mawuls, or hilly tracts along the Ghàts. The following are the products of the monsoon crop in the Desh: Jondla, *Andropogon Sorghum*, and of these there are many varieties; Sujgoora, *Panicum spicatum*; Rahleh, *Panicum Italicum*; Bhadlee, *Paspalum pilosum*; Kodroo, *Paspalum frumentaceum*; Mukka, *Zea Mays*[a]; Moog, *Phaseolus Mungo*, Ooreed, *Phaseolus radiatus*; Tooree, *Cytisus cajan*; Muht, *Phaseolus aconitifolius*; Teel, *Sesamum orientale*, two kinds; Ambaree, *Hibiscus Cannabinus*; Oolgeea, *Dolichos bifloris*; Waal, *Dolichos spicatus*; Rajgeerah, *Amaranthus oleraceus candidus*; Chuwluya, *Dolichos catiang*; and Gowarya, *Dolichos fabæformis*: there are thus seventeen products of the monsoon harvest of the Desh. The first six are bread grains, and are reduced to flour; Teel and Rajgeerah are eaten unground; Ambaree is a cordage plant, the rest are pulse, and are cooked in a variety of ways. Tooree is the universal substitute for the split pea of Europe; it is much more agreeable than the pea, and is more commonly used.

The produce of the rainy season harvest in the hilly tracts is Dhan, *Oryza sativa*, [b] seventeen or eighteen kinds; Natchnee, *Elevsine coracana*, or *Cynosurus coracanus*; Sawa, *Panicum miliaceum*; Wuree, *Panicum miliare*; and, finally, Karleh, *Verbesina sativa*. All these require a superabundance of water. The rice, which is the chief support of the people of the hilly tracts, is sown in the valleys, because it can be constantly flooded. Karleh is an oil plant only; the others are sown on the sides of the mountains, in places inaccessible to the plough. They are either used whole, or are reduced to flour for bread. Rice is never reduced to flour.

It is not to be understood, that the above products, as separated into those of the hilly tracts and Desh, are rigidly confined to those tracts; where the physical circumstances permit of it, they are indiscriminately cultivated in both tracts. The returns of some of the above plants are prodigiously great. I have seen a plant of *Paspalum frumentaceum*

a Indian corn. b Rice.

with twenty stalks radiating from a common root, and with thirty-three spikes of grain, giving the astonishing return of 61,380 for 1; a single head of *Andropogon Sorghum* gave 2895 for 1; eight stalks of *Panicum spicatum* from a single root 16,960 for 1; and a single head of *Panicum Italicum* produced 1850 for 1!!

Dry or Spring Season Harvest.—The next harvest is that of the Rubee, or dry or spring season of the Desh. In this harvest, of twenty-three products, there are four species of fine wheat, viz. Guhoo Bukshee, *Triticum spelta*; Kupleh Guhoo, *Triticum* ——; Kateh Guhoo, *Triticum* ——; and Pohteeyai, *Triticum* ——, called bellied wheat, from the seed being very much swelled out in the middle. Urburee, *Cicer Arietinum*; Shaloo, *Andropogon saccharatum*; Juw, *Hordeum hexastichon* [a]: Watanah, *Pisum sativum* [b]; Kurdee, *Carthamus Persicus*; Juwus, *Linum usitatissimum*; Mohuree, *Sinapis racemosa*, and two other kinds; Taag, *Crotolarea juncea*; Yerund Tambra, *Ricinus communis* [c]; Yerund Eerwa, *Ricinus viridis*; Oos Tambra, *Saccharum officinarum* [d]; Oos Poonda, *Saccharum* —— [e]; Oos Pandra, *Saccharum* —— [f]; Oos Bèt, *Saccharum*, —— [g]; Shet Wallook, *Cucumis* ——, the literal meaning is field cucumber; Pawteh, *Dolichos* ——; Tumbakoo, *Nicotiana tabacam*; Shet Kapoos, *Gossypium herbaceum* [h]; Bhoeemoong, *Arachis hypogæa.* [i]

The above are chiefly produced in the Desh, in the dry season. Urburee, *Cicer arietinum*, is the universal substitute for oats for horses; and, excepting in the rains when green grass is obtainable, the juicy, sweet, and nutritious stalks of the Shaloo, *Andropogon sorghum*, and varieties, is their only forage. Oil is expressed from the seeds of Kurdee, Juwus, Mohuree, and Yerand. Juwus is not used for its flax. Although there are four kinds of sugar-cane, and much raw sugar is produced, the processes of refining are not carried on. The bark of Taag is used for ropes and coarse canvas. The returns from the wheat are very considerable; I have a specimen of Kupleh Guhoo, with twenty-five stalks from one root, giving a return of 1450 for 1; ten stalks are very common; a specimen of the Kateh Guhoo, also in my possession, with fifteen stalks from a single root, giving a return of 480 for 1. The average on tolerable land is eight stalks or ears to a plant. The tobacco from some parts of the country is reckoned very fine.

The dry season harvest of the hilly tracts is almost entirely confined to Mussoor, *Ervum hirsutum*; and Pawta, a variety of *Dolichos Lablab.*

a Barley. b Peas. c Castor oil. d Red sugar cane.
e Variegated sugar cane. f White sugar cane. g Reed-like sugar cane.
h Field cotton. i The earth nut.

Garden produce.—The produce of the gardens is of great importance to the natives of India, from their poverty limiting them very much to a vegetable diet, corrected by aromatic seeds and condiments. Most of the plants cultivated in the gardens of the Desh are also produced in the gardens, where they exist, (which is rarely) of the hilly tracts. The products are forty-six in number, viz., Dhunya, *Coriandrum sativum*[a] ; Mehtee, *Trigonella fœnugrecum ;* Shepoo, *Anethum sowa ;* Bureeshep, *Anethum fœniculum* [b]; Wowa, *Ligusticum agivaen ;* Hulwee, *Lepidum sativum ;* Meerchya, *Capsicum annuum* [c] ; of this there are many species. Patee, *Allium cepa,* [d] red, white, and yellow ; some of which are so mild as to be used as vegetables. Chakweet, *Chenopodium album ;* Chooka, *Rumex Vesicarius* [e] ; Wahlea, *Basella rubra* and *alba ;* Aaloo, *Arum campanulatum ;* Tandoolja, *Amaranthus polygamus ;* Maat Tambree, *Amaranthus oleraceus,* var. ; Paluk, *Beta Bengalensis ;* Mohtee gohl, *Oxalis monadelphus ;* Gohl, *Portulaca oleracea ;* Pokulla, *Amaranthus,* —— ; Poodna, *Mentha viridis ;* Chundun Butwa, *Chenopodium,* —— ; Bhang, *Cannabis sativa* [f] ; and Nagwail, *Piper Betel.* The most valuable of the above plants produce aromatic or pungent seeds ; most of the rest are pot-herbs held in considerable estimation.

Edible roots.—The next division of garden produce is denominated Mool Bojee, which literally means "root-greens," properly edible roots. Mooleh, *Raphanus sativus* [g] ; Rutalee, *Convolvulus batatas* [h] ; Kohn, *Dioscorea purpurea* or *alata* [i] ; Gajur, *Daucus carota* [j] ; Lussoon, *Allium sativum* [k] ; Soorun, *Arum,* —— ; Rungeh, *Dioscorea fasciculata ;* Alluh, *Amomum Zingiber* [l] .

Fruit vegetables.—A further division is made of Phul bajee or fruit greens, which means fruits eaten as vegetables, viz., Bhendee, *Hibiscus esculentus ;* Wangee, *Solanum melongena,* [m] several species or varieties ; Gewree, *Dolichos,* —— ; the seeds are eaten as pulse, and there are several varieties ; Dorkee, *Cucumis acutangulus ;* Gosaled, *Luffa pentandria ;* Karlee, *Momordica Charantia ;* Tondlee, *Momordica monadelphia ;* Purwal, *Trichosanthes anguina ;* Purwar, *Trichosanthes cucumerina ;* Turkakree, *Cucumis usitatissimus ;* [n] Kateh Wallook, *Cucumis sativus,* warty, prickly cucumber ; Doodh Boplah, *Cucurbita longa ;* Boplah-tambra, *Cucurbita Pepo,* red pumpkin ; specimens of this fruit are sometimes more than eighteen inches in diameter ; Kohwall, *Cucurbita alba ;* Dhendsee, *Cucurbita,* —— ; Kasee Boplah, *Cucurbita lagenaria.*

a Coriander. b Sweet fennel. c Chilly. d Onions.
e Blister sorrel. f Hemp. g Radishes. h Sweet potatoes.
i Yam. j Carrots. k Garlic. l Ginger m Egg plant.
n Common cucumber.

Such are the cultivated garden products of the natives: it will be seen that they are rich in the cucurbitaceous family, and not less so in the aromatic and pungent plants; and the edible roots are various. Edible leaves, used as greens, are very numerous, particularly those produced spontaneously. My limits do not permit me to give even the names of wild plants producing greens, fruits used as vegetables, or edible roots; the flowers of some plants are used as greens; such as the Angustee, *Æschynomene grandiflora*; the Shewga, *Hyperanthera morunga*, or horse-radish tree; and those of the Kanchun, *Bauhinia purpurea*; the foot-stalks of the flowers of the splendid *Convolvulus candicans* are used in a similar way. The tender twigs of the common bamboo are good as greens, and they are also made into a pickle. The flower, stalks, and roots of the Lotus *(Nympha esculenta)* are reckoned fine; but I must stop.

Grasses.—The grasses are innumerable, and are not less distinguished for their beauty than their variety. One of the most common is that highly nourishing grass the *Agrostis linearis*, which, it appears, is a native of Cornwall, under the name of *Panicon dactylon*. In biting the knots or joints of the Ghateea *(Andropogon Martini ?)* there is a strong, pungent, aromatic, and oleaginous exudation. The well-known aromatic Khus Khus *(Andropogon muricatus)* is abundant in Dukhun, as well as the sacred grass Durb, *Poa cynosuroides*. In speaking of the grasses it may be as well to say that it is not the practice of the natives to make hay from meadows; they allow the grass on waste lands to become perfectly dry, and then cut it down with the sickle, as a substitute for hay.

Wild cordage plants.—The spontaneous cordage plants are the Gayal, *Agave vivipara*; the Kaswuree, *Sida patens*; and some others.

Wild oil plants.—The wild oil plants are the Kurunj, *Galedupa arborea*; and the Kurd Kangonee, a small tree of the class and order *Pentandria monogynia*.

Wild tanning plants.—The plants used in preparing leather are the Chambar Heerda, *Terminalia Chebula*; Rahn Turwur, *Cassia auriculata*; the Sadrah or Aaeen, *Terminalia alata glabra*; and the Baubul, *Mimosa arabica*, the bark of which is in great repute.

Medicinal plants.—The medicinal plants are numerous. Amongst the most useful are the Khyr, *Mimosa catechu*; the Seegeekaee, *Mimosa abstergens*; many species of *Datura*; Kuntuh Kareeka, *Solanum jacquini*; Sagurgotta, *Cæsalpinia bonduccella*; Korpur, *Aloe succotrina*; Dadmaree, *Euphorbia tirucalli*; Gooleea Eendrawun, *Cucumis colocynthis*; Reeta, *Sapindus detergens*; Sahl Phul, *Boswellia thurifera*; Bawcheea, *Psoralea corylifolia*; some of the *Ocimums*, and many of the *Asclepias*

family. Of the powerfully scented plants, the *Michelia Champaca*, (Champa), *Pandanus odoratissimus*, several species of Jasmine, Polyanthus, Rose, &c., abound.

European fruits.—Very few of the European fruits are cultivated in Dukhun : indeed, those produced are almost confined to peaches and strawberries, both of which are as fine as in Europe. All the European vegetables thrive, such as cauliflowers, cabbages, asparagus, spinach, and broccoli. Potatoes, when properly attended to, are also good. Carrots, turnips, and radishes are indigenous.

Flowering plants.—It is not within my present view to attempt an enumeration of the wild flowering plants of Dukhun, many of which are splendid and curious. Nothing can exceed the magnificence and beauty of the vegetation in the Ghàts during the monsoon. The brilliancy of the *Erythrinæ*, the *Cassiæ* (particularly the *Cassia fistularia*,) the lofty *Bombax*, the varieties of the *Liliaceæ*, *Cannæ*, *Convolvulaceæ*, and *Malvaceæ*, would surprise and delight a European florist.

In the Desh, the dwarf *Cassia auriculata*, with its numerous yellow flowers, enlivens the whole country; and the numerous species of *Mimosa* (particularly the *Mimosa odoratissima*), perfume the air.

The Dukhun produces few ferns and no heaths, and none of the coniferous family, excepting *Cupressus ;* the Musci (true mosses) are rare; there are many of the *Euphorbiaceæ ;* no oaks, elms, or hazels, or indeed any of the *Amentaceæ*, excepting *Salix tetrasperma ;* multiplied genera and species of the *Jasmineæ*, *Labiatæ*, *Compositæ*, *Umbelliferæ*, *Leguminosæ*, and *Cucurbitaceæ ;* the *Cruciferæ* are not abundant; but the *Capparides* are very much so. The rosaceous plants are rare; but the *Solanaceæ (Luridæ)* are very abundant; although the potatoe is not indigenous.

Such is the meagre sketch of the botany of Dukhun; for the elaboration of which there are abundant materials at the India House, in a Hortus Siccus collected by myself.

I must not omit to notice that the Sandal-wood tree, *Santalum album*, is met with, both in the cultivated and wild state.

Timber trees.—The Warsa, *Bignonia quadrilocularis ;* the Tamarind, *Tamarindus Indica ;* the Jack, *Artocarpus integrifolia ;* and the *Bauhineæ*, produce excellent wood for furniture; and all the species of *Mimosa* furnish hard durable wood for tools and machinery.

Zoology.

Like the account of the botany, the zoology must be confined to little more than a mere catalogue of the beasts and birds of the country.

The inhabitants of Dukhun have the Georgian form of skull: their stature is low, but not very slender; the colour of the skin is brown, with shades running into yellow and white in the higher classes, and black in the lower; the females are not distinguished for beauty or fertility, the average number of births to a marriage being less than in Europe; more males are born than females, and, unlike Europe, they preponderate through all periods of life.

Quadrumana.—Of the monkey tribe I met with only two kinds, *Semnopithecus Entellus* and *Macacus radiatus.* A new species described by me, *Cercopithecus albogularis*, was not from Dukhun.

Cheiroptera.—Three species of bats, Wurbagool, *Pteropus medius; Nyctinomus plicatus;* and *Rhinolphus Dukhunensis.*

Plantigrada.—Chuchoondur, *Sorex Indicus*, or musk-rat; Aswail, *Ursus labiatus*, or labiated bear; Juhl Manjur, *Lutra Nair*, otter.

Digitigrada.—Of these animals, the first is the Kolsun or wild dog, *Canis Dukhunensis*, which was first described and brought to Europe by myself; Landguh, *Canis pallipes*, wolf, a new species; Kholah, *Canis aureus*, jackal; Kokree, *Canis Kokree*, a new species of fox; of the *Viveridæ*, the Juwadee Manjur, *Viverra Indica* or civet cat of Dukhun; Moongus, *Herpestes griseus*, Mungoose; Ood, *Paradoxurus Typus*. The *Hyœna*, *Turrus* of the Mahrattas, *Hyœna vulgaris*, is common in Dukhun, and is capable of domestication like a dog. The *Felinidæ* are numerous, not only in individuals, but in species, excepting the lion, which is not met with. Puttite Wagh, *Felis tigris*, royal tiger; Cheeta, *Felis leopardus* or genuine leopard, is rare; but the Beebeea Wagh, or panther, *Felis Panthar*, is most abundant. Cheeta, *Felis jubata*, or hunting leopard, is common. Mota Rahn Manjur, *Felis chaus;* Lhan Rahn Manjur, *Felis torquatus*, or lesser wild cat; the preceding being considered the larger wild cat. The species of the genus *Felis* here terminate. Of the rat family there is the Ghoos, *Mus giganteus*, or Bandikoot rat; Chooa, *Mus decumanus*, or Norway rat; *Mus musculus*, the mouse; and a very pretty field mouse of a bright chesnut colour, which is a new *Mus oleraceus*, also a second new mouse, *Mus platythrix.* Of the squirrel family there are only two species; the first, a splendid animal as large as the *Sciurus maximus*, of a chesnut colour, with a whitish tail; I have called it *Sciurus Elphinstonii*, the Mahratta name is Shekroo: the other species is the Khurree, or *Sciurus palmarum.* The porcupine, Sayal, is a new species, which I have called *Hystrix leucurus.* The hare, Sussuh, which abounds in Dukhun, is the *Lepus nigricollis* of F. Cuvier. That very curious animal, the Pangolin, *Manis crassicaudata*, is common: the Mahrattas call it Kuwlee Manjur, or tiled cat, the scales being im-

bricated as tiles on the roof of a house. The Dookur, or wild hog, *Sus scrofa,* abounds: every village also has a number of tame hogs, which are the public scavengers, but all property in them is abjured by the inhabitants. The Dukhun is celebrated for a breed of fine horses with a dash of the Arabian blood in them: the pony also is bred to a great extent to carry baggage. The Ass, Gudha, *Equus asinus,* is not much larger then a good-sized Newfoundland dog; it is not met with in the wild state.

Ruminantia.—The Dromedary, Oont, *Camelus dromedarius,* is rarely bred in Dukhun, but is in general use; the two-humped camel is unknown. Of the other Ruminants, the first is a beautiful little creature called Peesoreh, *Moschus memina;* the next is the Sambur, *Cervus equinus,* of the size of a small cow; the third is the Baikur, *Cervus muntjak:* all the above are inhabitants of dense woods. Of the antelopes there are four species; Bahmunee Hurn, *Antilope cervicapra;* Kalesepee, or black tail, a new species, *Antilope Bennetti; Antilope quadricornis;* and finally, the Rooee, *Antilope picta,* or Nylgau: the two former are only found on the open plains; the two latter prefer the woods, but are sometimes seen on the plains. Goats, Bukree, *Capra hircus,* abound; and sheep are so extensively bred in Dukhun, that flocks of many thousands are constantly met with grazing on the uncultivated lands: the wool is coarse and crisp; the price of a sheep is from two to four shillings; they afford excellent, although small mutton. The Pohl is the Brahmany bull, with its remarkable hump, *Bos taurus* var. *Indicus,* and is a noble animal; when put into the yoke, or when employed in carrying loads, he is called Byhl, and he loses his hump and his fine appearance. The cow does not yield much milk. Cattle are extensively bred, as it is chiefly by their means the transit of merchandize is effected. The female buffalo, Muhees, *Bos bubalus,* is highly valued for the quantity of milk she gives. The male, called Tondgah, is used in the hilly tracts in ploughing the muddy fields for rice. The above is the catalogue of the *Mammalia* of Dukhun, and a few comments will suffice respecting it. The musk-rat is a pest, from its infecting with its nauseous odour everything with which it comes into contact, even a bottle of wine, although corked. The bear is harmless. The wild-dog hunts in troops in the woods, and runs down the fleetest of the ruminants. The wolves sometimes attack women and children, but never men. The jackals are in large troops, and do much damage in the vineyards. The fox is mostly solitary or in pairs. The moongus is useful in destroying snakes. The hyæna is cowardly, entirely nocturnal in his movements, and never attacks live animals. The royal tiger and the leopard are formidable to

man and beast; but the people consider themselves safe against the attacks of the panther and smaller cats, when armed with a good stout stick. The *Mus giganteus* undermines buildings. Of the rest of the wild animals it is not necessary to say more, than that they, like those just enumerated, are most of them objects of the chase with the Mahrattas, who are capital horsemen, and many of them keen sportsmen.

Birds.—The birds are very numerous; many of them not less useful to man, than agreeable from their plumage. Song-birds are, however, rare. My catalogue contains 232 species of the several orders, families, and genera.

Raptores.—There are 13 genera of the first order Raptores,—*Vultur Indicus, Vultur Ponticerianus, Vultur Bengalensis, Neophron Percnopterus, Haliaëtus Ponticerianus, Circaëtus brachydactylus, Aquila chrysaëta, Aquila bifasciata, Hæmatornus Bacha, Accipiter Dukhunensis, Accipiter Dussumieri, Astur Hyder, Falco Tinnunculus, Falco Chicquera, Circus pallidus, Circus variegatus, Milvus Govinda, Otus Bengalensis, Strix Javanica, Strix Indranee, Ketupa Leschenaulti,* and *Noctua Indica.* Of the above order there are two new *Accipiters,* one new species of *Circus,* one *Milvus,* and a *Strix.* The *Neophron* is the Ractamah of Bruce, the sacred vulture of the Egyptians, and it is a most useful scavenger, removing all offal matters. The golden eagle is the same as that of Europe, and so is the *Falco Tinnunculus;* and the harriers are scarcely distinguishable from the European birds. The falcons, hawks, and goshawks, are used by the natives in hawking.

Insessores.—There are 53 genera, and 116 species of the order *Insessores.* Few or none of these can be said to be useful to man, and only two of the species are songsters:—*Merops viridis, Hirundo filifera, Hirundo Jewan, Hirundo concolor, Hirundo erythropygia, Cypselus affinis, Caprimulgus monticulus, Caprimulgus Asiaticus, Caprimulgus Mahrattensis, Halcyon Smyrnensis, Alcedo rudis, Alcedo Bengalensis, Ceyx tridactyla, Muscipeta Paradisi, Muscipeta Indica, Muscipeta flammea, Muscipeta peregrina, Muscicapa melanops, Muscicapa Banyamus, Muscicapa Poonensis, Muscicapa cæruleocephala, Muscicapa picata, Rhipidura albofrontata, Rhipidura fuscoventris, Dicrurus Balicassius, Dicrurus cærulescens, Hypsipetus Ganeesa, Collurio Lahtora, Collurio erythronotus, Collurio Hardwickii, Lanius Muscicapoides, Graucalus Papuensis, Ceblepyris fimbriatus, Ceblepyris canus, Oriolus galbula, Oriolus melanocephalus, Oriolus Kundoo, Turdus macrourus, Turdus Saularis, Turdus cyanotus, Petrocincla Pandoo, Petrocincla Maal, Petrocincla cinclorhyncha, Timalia Malcolmi, Timalia Somervillei, Timalia Chataræa, Ixos jocosus, Ixos ca-*

fer, Ixos fulicatus, Pomatorhinus Horsfieldii, Iora Tiphia, Sylvia montana. Sylvia sylviella, Sylvia Rama, Prinia socialis, Prinia inornata, Orthotomus Bennettii, Orthotomus Lingoo, Budytes citreola, Budytes melanocephala, Budytes Beema, Motacilla variegata, Motacilla Dukhunensis, Megalurus ruficeps, Anthus agilis, Saxicola rubicola, Saxicola bicolor, Saxicola rubeculoides, Saxicola erythropygia, Phœnicura atrata, Phœnicura Sueciea, Parus atriceps, Parus xanthogenys, Alauda Gulgula, Alauda Deva, Alauda Dukhunensis, Mirafra phœnicura, Emberiza melanocephala, Emberiza hortulana, Emberiza cristata, Emberiza subcristata, Linaria Amandava, Ploceus Philippensis, Ploceus flavicollis, Fringilla crucigera, Lonchura nisoria, Lonchura cheet, Lonchura leuconota, Passer domesticus, Pastor tristis, Pastor Mahrattensis, Pastor roseus, Pastor Pagodarum, Corvus culminatus, Corvus splendens, Coracias Indica, Buceros, several species, *Palæornis torquatus, Palæornis melanorhynchus, Bucco Philippensis, Bucco caniceps, Picus Mahrattensis, Upupa minor, Leptosomus Afer, Eudynamys orientalis, Cuculus canorus, Cuculus fugax, Centropus Philippensis, Chloropsis aurifrons, Cinnyris lepida, Cinnyris currucaria, Cinnyris Vigorsii, Cinnyris minima, Cinnyris Mahrattensis,* and finally, *Cinnyris concolor.* The above catalogue requires very few observations. The weaver-bird, *Ploceus Philippensis,* is remarkable for its pendent nest, woven in the most curious and ingenious manner from fibres of grass. Not less curious are the nests produced by the tailor-birds, the *Prinia socialis* and the *Orthotomus Bennettii,* which sew leaves together to inclose their nests, with the skill of a veritable knight of the thimble. The lark, *Alauda Gulgula,* has the habits and delightful song of the skylark of Europe ; and two or three species of the genera *Budytes* and *Motacilla* have sweet notes : the *Collurio Lahtora* has also a sweet note. The *Muscipeta Paradisa* and *Indica* are distinguished for their beautifully elongated tail-feathers. The *Coracias Indica* is characterized by its splendid colouring ; and not less so is the *Cinnyris Vigorsii.* The cuckoo is the identical bird of Europe, and so is the sparrow. In the above list I have named many new species of *Insessores,* and have introduced one new genus.

Rasores.—That order so highly useful to man, the *Rasores,* does not contain one single species in Dukhun that is not valuable as an article of food. There are 12 genera and 40 species. *Ptilinopus Elphinstonii, Columba mœna, Columba tigrina, Columba humilis, Columba rasoria, Columba Cambayensis, Columba Ænas, Meleagris Gallopavo, Pavo cristatus, Gallus giganteus, Gallus Sonneratii, Gallus domesticus, Gallus morio, Gallus crispus, Numida Meleagris, Coturnix dactylisonans, Cotur-*

nix textilis, Coturnix Argoondah, Coturnix Pentah, Coturnix erythrorhyncha, Perdix picta, Francolinus Pondicerianus, Francolinus spadiceus, Pterocles exustus, Pterocles quadricinctus, Hemipodius pugnax, Hemipodius Taigoor, Hemipodius Dussumier, Otis nigriceps, and *Otis fulva.* Of the above, turkeys and guinea fowls are not indigenous, and it may be doubted whether the gigantic cock be a native. The original of the domestic fowl is most abundant in the woods of the Ghàts. The real partridge, *Perdix picta*, is found in the valleys of the Ghàts. What is usually denominated a partridge in Dukhun, is the *Francolinus Pondicerianus* ; it is numerous, and affects cultivated lands and garden grounds. The common quail of Europe is a native of Dukhun ; and three new species, which I have described, as well as the *Coturnix textilis*, literally swarm. That noble bird the *Otis nigriceps* is met with in large flocks, and the floriken is by no means scarce.

Grallatores.—Of the fourth order, *Grallatores* or Waders, there are 25 genera and 46 species, and very many of the species are common to Europe. *Grus Antigone, Ardea Egretta, Ardea Garzetta, Ardea Asha, Ardea cinerea, Ardea nigrirostris, Ardea Malaccensis, Ardea Caboga, Ardea Grayii, Ardea Javanica, Ardea cinnamomea, Botaurus stellaris, Nycticorax Europœus, Phœnicopterus ruber, Platalea leucorodia, Platalea junior, Ciconia leucocephala, Ciconia Argala, Anastomus Typus, Tantalus leucocephalus, Ibis religiosa, Ibis ignea, Ibis papillosa, Ibis falcinella, Totanus ochropus, Totanus Glareola, Totanus hypoleucos, Limosa Glottoides, Limosa Horsfieldii, Gallinago media, Gallinago minima, Rhynchea picta, Pelidna Temminckii, Parra Sinensis, Gallinula Javanica, Rallus Akool, Porphyrio Smaragnotus, Fulica atra, Cursorius Asiaticus, Vanellus Goensis, Vanellus bilobus, Charadrius pluvialis, Charadrius Philippensis, Himantopus melanopterus*, and *Œdicnemus crepitans.* Of the above, the *Ibis religiosa* is undoubtedly the sacred or mummy *Ibis* of the ancient Egyptians, according to Cuvier's description. The species of the family of the *Ardeidœ* are varied and beautiful. The snipes are those of Europe, as well as most of the species of the *Scolopacidœ*, and some of the *Rallidœ.*

Natatores.—The last order, *Natatores*, or swimmers, contains 13 genera and 20 species, and, as in the preceding order, several of the species are common to Europe. *Plectropterus melanotus, Anser Giria, Tadorna rutila, Anas strepera, Rhynchaspis virescens, Mareca pœcilorhyncha, Mareca fistularis, Mareca Awsuree, Querquedula* Circia, *Querquedula Crecca, Fuligula rufina, Fuligula* ——, *Fuligula cristata, Podiceps Philippensis, Phalacrocorax Javanicus, Plotus melanogaster, Sterna acuticauda, Sterna similis, Sterna Seena*, and *Viralva Anglica.* The geese,

ducks, and teals abound most in the cold season, and are at that period excellent eating. The domestic goose and duck of Europe is not included in the above list, but both are extensively bred in Dukhun. That rare English bird the *Viralva Anglica* is very common in Dukhun. I did not meet with the Pelican, although it is a native of India.

Ichthyology.—The rivers of Dukhun abound with fish, and some of them are not only palatable, but very fine flavoured, particularly the Tambra, a new species of *Cyprinus*, and the Waam, *Macrognathus armatus;* the Singhala or *Pimelodus* is also in very general use by the people, but is not esteemed by Europeans. The fish observed by me consisted of forty-six species; two belonged to the sub-order *Apodes*, three to *Thoracici*, and forty-one to *Abdominales*. The whole were comprised in twelve genera. There was one *Murena*, one *Macrognathus*, one *Chanda*, one *Ophiocephalus*, one *Gobius*, two species of *Silurus*, nine of *Pimelodus* and sub-genera, one *Ageneiosus*, one *Mystus*, twenty-four of *Cyprinus* and sub-genera, one *Essox*, and three species of *Cobitus*. It is remarkable that the fresh water *Essox* of Dukhun so closely resembles the salt water species of England, as to be scarcely distinguished from it, not only in external characters, but in the colour of its bones.

Reptilia.—Reptiles are numerous in Dukhun. The *Trionyx Indica* abounds in the rivers, and there are two smaller species. Many genera of the Saurian family are met with from the four to five feet *Monitor* to the minutest *Lacerta*. Serpents of all kinds, from the gigantic Boa Constiictor to the small and beautiful carpet snake. The first, however, I have only seen carried about the country by people who exhibit the feats of the reptile in swallowing small animals. Independently of the deadly *Cobra da Capello*, (*Caluber Naag*) there are some other poisonous species, but in general the snakes are harmless.

Crustacea.—Of the *Crustacea*, I shall have only to notice the Kenkra, *Thelphusa cunicularis*, a new species which pervades the valleys and table-lands of the Ghàts, and whose numbers are so great that their burrows riddle the earth; they remain quiet in their holes during the cold and dry seasons, but, in the monsoon, they are abroad in such numbers, that travellers drive over them, ride over them, and trample upon them in the high roads: they are not an article of food with the natives, but are, I believe, wholesome.

Testacea.—There are some few genera and species of land and fluviatile shells, the largest of which is a *Unio*; but they do not call for notice.

Entomology.—Like all tropical climates, the Dukhun teems with insects. The domestic fly is a pest at certain seasons; the most rigid precautions and the greatest cleanliness cannot secure the most fastidious person from the inroads of the bed-bug; and there is no getting beyond the "*maximum leap of a flea*"; the fact is, these plagues are not only the constant companions of the people, but the flea inflicts serious injury on poultry, dogs, and cattle. Domestic, and indeed wild animals are subject also to the attacks of a small blue tick, *(Acarus,)* which multiplies upon them in such an incredible manner as to affect the vital functions and produce paralysis and death. There are three species of honey-bee in Dukhun, the honey from the whole of which is remarkably fine. It boasts also its lac insect, *Coccus laccus*; and several silk-producing moths, particularly the Kolesurra, *Bombyx Paphia.*

The most destructive of the insect tribe is the white ant, *Termes,* which, working under cover with the most indefatigable perseverance, finds its way everywhere, and everywhere occasions loss and injury; books, papers, clothes, leather, wood, &c., are indiscriminately devoured. Several species of genuine ants are also a great nuisance. A species of sphex makes its earthen nest within the locks of the doors, and blocks up the key-holes. The musquito, *Culex,* is not quite so troublesome in Dukhun as on the coast. The scorpion, of which there are two or three species, so abounds in the stony lands of Dukhun, that on encamping my regiment, on the march from Punderpoor to Ahmednuggur in 1818, I had from two to three hundred brought to me in the course of a day by my men: their sting produces intolerable pain for a few hours, but is not dangerous unless to the diseased and weakly. The centipede does not attain the growth of its type in South America, nor is it very numerous.

As in other countries, the *Coleopterous* order is the most numerous. Some of the genera are remarkable for their habits, *(Copridæ,)* and some are remarkable for their beauty *(Buprestidæ).* Amongst the *Lepidoptera* many are very handsome, both in the diurnal and nocturnal families *(Papilio Hector* and *Bombyx Atlas).* In the *Hemipterous* order, the *Cimicidæ* abound, and are cursed with all imaginable abominable smells. In the order *Orthoptera,* the *Gryllidæ* are numerous; but the locust is unknown as a scourge. In this order also, the multiplied and strange forms of the *Mantis* and *Phasma* are very striking. The *Blatta* is troublesome and injurious. The *Hymenoptera* includes some valuable and interesting genera. Of the *Apterous* insects I have already spoken. The *Neuroptera* are both numerous and beautiful, some of the *Libellula* and *Myrmeleons* particularly so. Of the *Diptera,* the genera *Musca,*

Culex, *Bombilius*, *Hippobosca*, and *Tipula*, exhibit the greatest number of species and individuals. In *Arachnida* the genera are endless. The prevalence of scorpions I have spoken of.

Civil Divisions.

The British territories in Dukhun are divided into four collectorates, Poona, Ahmednuggur, Dharwar, and Khandesh or Candeish. Over each of these there is a European civil servant of the Company, with several European assistants, for the purpose of collecting the revenue. These gentlemen are armed with magisterial powers, and can call upon the military authorities for assistance. These collectorates are divided into Talooks (great divisions), provinces, Pergunnahs (counties), and Turrufs (hundreds);* and native officers called Mamlutdars, aided by inspectors of cultivation, accountants, treasurers, and a police force, are placed over one or more Pergunnahs. All these terms are of Moosulman introduction; the ancient Hindoo civil officers being differently named, and their territorial divisions were Pránt, Deshmookee, and Naikwaree. The aggregations of habitations are called Sher (city), Kusbeh (market-town), Mouzeh or Gaòn (village), and Waree (hamlet). The cities and towns may comprise several villages, and they have their suburbs called Peit. The village constitution is noticed under land tenures.

Poona Collectorate.—The Poona Collectorate is the nearest of the four collectorates of Dukhun to Bombay: its boundaries towards the coast approach within about fifty miles of that presidency, but they do not descend the Ghàts into the strip of land at the foot of the Ghàts, called the Konkun (Concan). This collectorate has an area of 8281 square miles, including the lands held in military tenure (Jagheer). It contains 550,313 inhabitants, 1897 towns† and villages, and 114,887 houses; averaging 66·45 inhabitants to a square mile, 4·79 to a house, 247·36 to a village, exclusive of the population of Poona. The chief town is Poona, recently the capital of the Mahratta empire, containing a population of 81,315 souls. The other principal towns are Tullegaon (2050 males, 2007 females), Joonur (4218 males, 3759 females), Kheir (1999 males, 1794 females), Goreh (1154 males, 1145 females), Ootoor (2521 males, 1928 females), Narraingaon (1286 males, 1180 females),

* Provinces, counties, and hundreds are not the exact equivalents of the native territorial divisions, but they afford sufficiently approximate types.

† Trifling transfers have taken place between the different collectorates, so that this may not be the exact amount at the present moment,

Alley (1396 males, 1064 females), Sassor (1880 males, 1696 females), Jeejooree (885 males, 860 females), Tullegaon, *Turruf Paubul* (1710 males, 1427 females), and some others; but the most populous of the number, as is seen above, contains only 7977 souls. There are, excluding Sholapoor, 8 pergunnahs and 32 turruffs in the Poona collectorate. In Sholapoor sub-collectorate there are 4 talooks, 19 pergunnahs, and 12 turruffs; but as divisions which in the other collectorates are called turruffs, are here called pergu nnahs, there are few turruffs. My limits will not permit of detailed descriptions of these pergunnahs, although there are many physical facts of interest connected with some of them.

The following number of towns and villages constitute the different pergunnahs and talooks: Sewnere 190, Indapoor 86, Kheir 236, Pabul 65, Poorundhur 130, Beemthuree 92, Hawailee 165, the Mawuls 233, Sholapoor 122, Mohol 145, Indee 236, and Moodebehal 226. This makes a total of 1926, which is 29 villages more than was previously stated, but this is owing to depopulated villages being included; of this 1926, 47 towns and 1429½ villages belong to the British; 4 towns and 264½ villages are held in free gift (Eenam), and 3 towns and 178 villages are held on tenure of military service (Surinjam).

Hill forts.—In the Poona Collectorate are situated many remarkable hill forts, impregnable in fact if properly defended, from their geological structure, which consists of beds of basalt, with vertical edges, alternating with beds of amygdaloids, whose edges form a talus. Many of these in their superficial plane manifest a strong disposition to a trigonal character. Such is the case with Teekonee (the word being almost Greek,) or three-angled, Koaree, and some others. Koaree is situated at the edge of the Ghàts in the civil division called the Powar Khoreh; its summit is 2910 feet above the sea; and some parts of the rock within its area are so powerfully magnetic, as to draw the needle quite round the compass. The hill forts of Singhur, Poorundhur, and Wuzeerghur are seen from Poona: the summit of the first is elevated 4192 feet above the sea, and the second 4471 feet. The hill-fort of Sewnair, in which the celebrated Sewajee was born, is situated close to the city of Joonur (Jooneer). Jewdun, is on the edge of the Ghàts, a few miles westward of Joonur, and Hurreechundurghur, which is said to be eighteen miles in circumference at its base, is situated a few miles N. W. of Joonur. But I have not space to enumerate all these points of defence provided by nature,—Loghur, Eesapoor, &c. &c.

Boodh cave-temples.—Some works of art must not be overlooked. The first is that magnificent cave-temple situated in the civil division called Naneh Mawul; it is usually denominated the cave of Karleh (Carlee),

from being within two miles of a village of that name; the temple is associated with many cave-chambers. The other Boodh excavations are pierced in the hills around the city of Joonur, under the hill-fort of Joonur, and at the crest of the pass into the Konkun from Joonur, called the Naneh Ghât. Numerous inscriptions, in so antique a form of the Sanscrit alphabet as not to be readable by modern Sanscrit scholars, abound in these caves.* These astonishing works of art, resulting from the labour of ages, and which are met with, not only in the Poona Collectorate, but in many other parts of India, would seem to indicate that the country was once inhabited by a Boodhist population, although it has so entirely disappeared, that not a solitary worshipper of Boodh remains in the peninsula of India.

In the Under Mawul, at the village of Mhow, there is an extraordinary large Wuhr-tree (*Ficus Indica*); it has sixty-eight stems, most of them thicker than a man's body, and, with the exception of the original stem, the whole of them originate in roots let down from the branches; it was capable of affording shade, with a vertical sun, to 20,000 men, being 201 feet long by 150 feet broad. At the town of Munchur, in the pergunnah of Pabool and Turruf Wurgaon, there is a Baubel-tree *(Mimosa Arabica)*, of surprising magnitude; at eighteen inches from the ground the trunk measures nine feet and half an inch in circumference; its head is ramous and dense, and it gives a vertical shade covering 5964 square feet: this species produces gum arabic. In the turruf of Chakun, pergunnah Kheir, near to Mahloongah, on the slopes of some hills, the shrub or small tree, producing the gum olibanum, *(Boswellia thurifera)*, is met with; and it is seen also in other parts of the country. At Mahloongah there is a garden of flourishing cocoa-nut trees; and considering that they are at 2000 feet above the sea, and 100 miles inland, the fact is sufficiently remarkable: clumps of them are also met with at Pabool and other places.

Rivers.—The rivers flowing through the Poona Collectorate are the Mota, the Mola, the Inderanee, Under, Beema, Goreh, and Kokree, and some smaller streams. All these have their sources in the Ghâts, within the limits of the collectorate; they converge to the Beema, which falls into the Kistnah, and thus finally reach the Bay of Bengal. The rivers are only navigable during the monsoon, and then only partially. Boats with sails are not seen upon them.

* Within the last year, those indefatigable and learned orientalists, Principal Mill, Mr. James Prinsep, and Mr. Stevenson have succeeded in reading most of the inscriptions which are found to relate exclusively to Boodhism and Boodhists.

Ahmednuggur Collectorate.—The Ahmednuggur Collectorate adjoins the Poona Collectorate on the east and north. Part of its frontier is along the Ghàts; the rest is bounded by the Chandore range of hills on the north, and by the Nizam's territories on the east and S. E.

Ahmednuggur has an area of 9910 square miles; it contains 666,376 inhabitants, dispersed in 2465 towns and villages, averaging 263·47 inhabitants to a village, (exclusively of the population of Ahmednuggur); 67·24 inhabitants to a square mile; 136,273 houses and 4·89 inhabitants to a house*.

Ahmednuggur is divided into 14 talooks, 36 pergunnahs, and 51 turruffs. Talook Ahmednuggur contains 157 towns and villages, Kurdeh 172, Sungumnair 226, Akoleh 194, Newassa 359, Nasseek 280, Sinnur 107, Chandwur 153, Patodeh 255, Wun Dindooree 175, Barsee 124, Kurmulleh 82, Jamkheir 90, and Kortee 115. The total of these is 2438, instead of 2465; the difference originates in 23 depopulated villages being included. Of the above, 43 towns and 1858½ villages belong to the British; in 27 towns and 554¼ villages the British government has a quit rent, these villages being called Doomaleh,† alienated. Only one village in free gift was returned to me, and one town and three villages in military or feudal tenure; but the villages in free gift (Eenam) are included in the Doomaleh villages.

The chief town is Ahmednuggur, with a population of 17,838 souls in 1822: men 5953, boys 3350, total males 9303; women 5976, girls 2559, total 8535. The other chief towns are Kurdeh, Nasseek, Chandore, Sungumnair, Parnair, &c.; but their population I cannot state, as the total amount of the population of pergunnahs only was sent to me by the collector‡. The most populous pergunnah would appear to be Nasseek, containing 71,581 inhabitants. The least populous pergunnah was Soagaon, containing only 9400 inhabitants.

Rivers.—The rivers running through the collectorate are formed by numerous streams originating in the Ghàts and Chandore range,—such as the Peera, the Mool, the Doornah, and the Gooee, which converge to that noble stream the Godavery, which also has its rise in this collectorate, near Trimbuck, and flows to the eastward to the Bay of Bengal.

* This return is for 16 pergunnahs only.

† The proper meaning of Doomaleh is "two properties," the chief part of the revenue being alienated, but the government having a quit rent.

‡ The population returns forwarded by me not having been filled up, in consequence of a census of the population having been made by the collector himself within three years preceding.

The Seena is the only river of consequence which does not originate in the Ghâts. It has its course at the edge of the plateau on which the city of Ahmednuggur stands, about ten miles north of the city, and flows in a S. S. E. direction into the Beema.

There are several remarkable hill forts in the western part of the collectorate, such as Trimbuck, &c. Ahmednuggur was once the capital of the Ahmed Shahee dynasty of kings.

Khandesh or Candeish Collectorate.—The area of the province or collectorate of Candeish, deduced from a map in the Deputy Surveyor General's Office, including tracts belonging to foreign states and to Jagheerdars, is 12,527 square miles. It is bounded on the north by the Sautpoora mountains; on the east by the province of Berar, belonging to the Nizam; on the south by the Indyadree range of mountains, which separate it from Ahmednuggur; and, on the west, by Dang and Raj Peeplee, which bring it into contact with Goojrat. It is literally a Khind or Khund, a great *gap* between ranges of mountains, whence its name of Khandesh or Candeish. Some of the northern and western parts are little better than a jungle, and the whole province is miserably depopulated. The populated part of the collectorate belonging to the British, derived from the returns of the lands of 1982 populated villages, give an area of 6760 square miles, with a population of nearly 55 inhabitants to the square mile; but supposing 1684 alienated and deserted villages to have a proportionate quantity of lands, the area will be 12,504 square miles, with $38\frac{1}{3}$ inhabitants only to the square mile, and this I believe to be very near to the truth. It is curious that the area derived from the village lands should approximate so closely to the area determined trigonometrically.

The collectorate is divided into sixty-six pergunnahs, some of which do not contain more than one village each, whilst the largest, Nandoorbar, has 259 towns and villages, Nowapoor 236, Sooltanpoor 232, Rawere 160, Jamnair 144, Amulnair 140, and Bhamere 150, including deserted villages. The total number of towns and villages is 3666; but of this number 330 are *pyegusta*, which means that the villages are deserted, but that part of the lands are cultivated; 999 are entirely deserted; but great confusion and uncertainty prevails in the details, for of this number there are 51 whose limits are unknown, 12 whose sites are *unknown* but names known, and 135 whose *names* and sites are unknown but a record remains of their number. There are 227 populated Jagheer, or alienated villages; and many amongst the Pyegusta, and deserted also, belong to Jagheerdars, so that it does not appear that more

than 2032 populated villages belong to the British *; of this number 1968 sent in population returns. The most populous town in Khandesh was Nandoorbar, and it had only 6429 inhabitants; and only one other town (Chopra) had a population of 6000. The towns and villages average only 178 inhabitants, and each house averages 3·96 inmates. The total of the inhabitants is 478,457.

From the village lands in Khandesh being kept universally in Beegahs, the amount of land under cultivation is readily determined. It would appear that 15,958 acres were watered by perennial streamlets. Lands so watered are called *pahtstul,* and are the most valuable of all, as the supply of water is mostly permanent, and the chief labour required is to open the channels and let it flow over the lands; 46,064 acres were watered from wells, and lands so watered are called *Mohtstul*:† 600,556 acres were under field cultivation, and are not watered,—these lands are called *Zerhaeet.* The per centage of cultivated and waste lands in this collectorate is as follows:—

Watered by perennial streams Watered from wells.............. Field cultivation..................	15·32 per cent.
Waste land............................	84·68 do.
	100...

Rivers.—The River Tapty runs through the whole length of the collectorate, and, unlike the rivers of the other collectorates, disembogues into the Gulf of Cambay, below Surat; the water-shed of the country being in fact from the east to the west, instead of from the west to the east; there are some exceptions in rivers which rise in the Western Ghàts, or the Chandore range, and run to the east for some distance, then sweep round in a segment of a circle and join the Tapty; such are the Guirna, Roharee, the Moosum, &c. Timber is floated down the Tapty in the monsoon.

Boodh Cave Temples.—Near to the Adjunta Pass, through the Chandore range, from Ahmednuggur into Khandesh, or a multitude of those astonishing remains of Boodhist art, consisting of excavations in the mural faces of the trap rocks, the interior walls of which excavations are

* In the Collector's revenue return for 1827-8 the number of villages is stated to be 2697½, so that 335½ of the deserted villages had become inhabited, independently of 330 uninhabited villages whose lands were included in the return.

† Paht means a water-channel, and Moht means a well-bucket; implying in the first instance that lands are watered from streamlets, and in the second instance from wells.

covered with bas-reliefs; indeed, with fresco paintings also, illustrative of the arts and social relations of life, like the paintings on the tombs of the Egyptian kings.

Dharwar Collectorate.—Agreeably to information obtained from the Revenue Survey Department, that part of the southern Mahratta country, bounded on the north by the Kolapoor territory and the Kristna river, on the east by the Nizam's dominions, on the south by Mysore and the Toomboodra river, and on the west by Soonda and the Sybadree Ghâts, comprises an area of 11,747 square miles, namely,

	Square Miles.
British possessions........	8378·439
Do. Manowlee Talook, from the Kolapoor territory.........	390·474
Sawanoor Jagheer....................................	74·750
Sawuntwaree territory	188·934
Nizam's territory..	47·930
Gudjundurghur jagheer.................................	69·344
Putwurdun and other jagheers.........................	2597·167
Total........	11747·038

The Talooks of *Cheekooree*, 354 square miles, and *Munowlee*, 390 square miles, have been added to Dharwar, so that the area of the collectorate now amounts to 9122·913 square miles; but 39 per cent. of this consists of wood and jungle, and uncultivated lands, and 61 per cent. appears upon the returns as cultivated.

Dharwar is divided into 22 Talooks and 137 *Turruffs, Mahls, Summuts*, or *Khiryats*, independently of the subdivisions of the Talooks of Cheekooree and Munowlee. The Talook of Dharwar has 136 towns and villages, Meesreekoht 133, Purusghur 59, Nowlgoond 43, Hoongoond 170, Dumbul 96, Bunkapoor 115, Nuwee Hooblee 97, Ranee Beednoor 139, Kettoor 81, Sumpgaon 70, Beereeh 135, Rhone 77, Bagulkoht 141, Hangull 173, Goottull 123, Badamee 148, Padshapoor 202, Kohr 182, Talooks of Cheekooree, and Munowlee 225. To the above are to be added 189 villages, 47 of which sent in poppulation returns, although their names were not in the government list; 108 were not included because they were Jagheer or Eenam villages; and 34 were depopulated and overlooked. The total number of villages in the collectorate amounted to 2734; of this number 2491 were populated, and 243 were deserted. Of the above, 1899 British villages sent in returns, 225 did not send returns; 155 were deserted, but their lands were under cultivation by neighbouring villagers; 230 alienated villages sent in returns, 137 alienated vil-

lages did not send in returns; and 88 deserted villages had not their lands under cultivation. With the aid of some trifling estimates the total amount of population appeared to be 838,757, averaging 91·94 inhabitants to the square mile, 336·71 to a village, and 4·48 to a house. Of the 119 British towns, there are only three whose population exceeds 10,000 souls, viz. Dharwar 11,802; Belgaon 11,037; and Mujeedpoor 15,387. One town has above 8000 inhabitants, (Bagulkoht); two with 6000; one 5000; thirty-six with from 2000 to 4000; and seventy-seven with from 1000 to 2000 souls. All the village lands being kept in definite measurements, it appeared that the cultivated land of the whole collectorate was 61·11 per cent., and waste only 38·89 per cent.

Rivers.—All the chief rivers of Dharwar flow to the eastward; they have their source in the Ghàts, and join the Kistnah. The principal are the Gutpurba, the Malpurba, and the Wurdah: the falls of the Gutpurba, near to Gokauk, are said to be strikingly fine.

Hill Forts.—Dharwar, like the other collectorates, has to boast of its hill forts.

Viewing Dharwar, whether with respect to its numerous towns and well-peopled villages, the comparative density of its population, the size of its farms, the quantity of land in cultivation, the amount of its revenues, the lightness with which they press supposing they were raised as a poll tax, the indications of manufacturing industry (so languishing elsewhere) in the number of its weavers, and its superior means of school instruction, it is unquestionably the finest of the British possessions in Dukhun.

Population.

The great feature in the population of Dukhun is the excess of males over females in a greater proportion than exists in Europe. By the last census in England there were 100 males to 93 females. In the British possessions in Dukhun, in a population from which returns have been received of 2,302,902 souls, there are 100 males to 87·36 females, and this difference obtains, with very little variation, throughout the different casts. It is subject to modification, however, by a very singular fact, exhibited in the excess of grown up women over men wherever the returns distinguish the adults from children; but the excess of male children over female leaves the ultimate preponderance in favour of the males. From Sir Stamford Raffles' *History of Java*, the same relative proportion of the sexes would appear to exist in that island. He states that the proportion of males and females born in Bantam, and over the whole of Java, is nearly the same as in Europe, and as is found generally

to exist wherever accurate statements can be obtained. From the information he collected in a very careful survey of one province, the preponderance seemed to be on the side of male children to an extraordinary degree; the male children being about 42,000, and the female 35,500, i. e. 100 males to 84·52 females. He says also there were formerly great drains on the male population, and which, in advanced stages of life, might turn the balance on the other side; indeed, in some of his returns this is shown to be the case.

In Dukhun, wherever the means have been afforded to me of ascertaining, I have found the preponderance of male over female children to be marked, not only in births, but as long as they continue to be classed as children; although a great mortality, at a subsequent period, makes the grown up females outnumber the grown up males.

Males and females.—In the Poona Collectorate in 1826 the births of males in 32 turruffs were 100 to 94·27 females, or very nearly 20 males to 19 females. The result of eighteen years' very careful observations for all France, from 1817 to 1834 inclusive, gives 17 males for 16 females; and as this is derived from more than seventeen and a half millions of births, it is worthy of every confidence. Taking each year of the above period, the extreme variation was from 15 males to 14 females as far as 19 males to 18 females. My deduction varies so little, that we may fairly say the same law equally obtains, whether in a tropical or an extra-tropical climate. Amongst illegitimate births in France it would appear that the number of females approximates more nearly to males than in the legitimate births; the numbers, according to the French tables, being 24 males to 23 females: reducing all these to a common denomination, we have in the

Poona Collectorate.........	94·27	per cent. of female births.		
In France, the average of 18 years, legitimate....	94·11	do.	do.	
In France, legitimate for 1 year,.......	93·33	do.	do.	extremes.
In France, legitimate for 1 year,.......	94·73	do.	do.	
In France *illegitimate,* average of 18 years,	95·83	do	do.	

It would thus appear that amongst illegitimate children there are nearly two more females born to every hundred males than amongst legitimate births.

In the abstract of the census of the population of the Ahmednuggur Collectorate, taken in 1822, the boys were to the girls as 100 to 62·16; a singular disproportion; there being in the whole collectorate 96,447 boys, and only 59,956 girls; but the men were to the women only as 100 to 102·18, the number of men being 146,750, and the women 149,945. In the city of Poona, in 1822, the boys were to the girls as 100 to 73·26, a greater disproportion than Sir Stamford Raffles found in Java; at the same time the adult men were to the women as 100 to 103·40. In the classes only of the Brahman priests, mendicants, and traders, were the men found to exceed the women. In the city of Ahmednuggur, in 1826, there were 100 boys to 67·62 girls, but 100 men only to 106·06 women; but the ultimate relation of males to females was as 100 males to 92·46 females.

The following table shows the proportion of males to females in the different collectorates, and their principal cities and towns:

Collectorates.	Males to Females.	Cities and Towns.	Males to Females.
Poona Collectorate	100 to 88	Poona	100 to 94
Ahmednuggur do.	100 to 86	Ahmednuggur	100 to 92
Khandesh do.......	100 to 85	Joonur...............	100 to 89
Dharwar do.	100 to 89	Dharwar	100 to 98
		Belgaon	100 to 91
		Bagulkoht	100 to 101·25
		Gunness Part......	100 to 101·14

Births, Deaths, and Marriages.—Returns of births, deaths, and marriages, in an available form, were received only from 32 turruffs of the Poona Collectorate, comprising 1109 towns and villages, but not including the city of Poona, containing 81,315 inhabitants; my information, therefore, on these subjects must necessarily be circumscribed, but the little there is is valuable from its novelty. Some returns came to hand from the Collectorate of Dharwar, but they were merely additions of the totals of irregular numbers of villages, (from 2 to 12,) and I hesitated

to trust to results which I could not test by the original returns. Respecting births, deaths, and marriages in the Ahmednuggur and Khandesh Collectorates, I am totally without information, excepting a solitary return of deaths in the city of Ahmednuggur in 1828, which is worthy of every confidence, as it was compiled by my friend Dr. Walker, late Civil Surgeon at Ahmednuggur.

Births.—In the Poona Collectorate the average births, in a population of 250,300, amounted only to one in 50·52 persons, or not quite two per cent.; the Brahmans having the smallest proportion, (1 in 57·29), and the Moosulmans the greatest proportion, (1 in 40·80); the range of births in the different turruffs was from 1 in 15·70 to 1 in 153·60 persons; and, on the whole, the hilly tracts had a greater number than the plains.

Deaths.—The deaths were 1 in 37·34 persons in the 32 turruffs, or 2·67 per cent., indicating a somewhat alarming diminution in the population;* the range varied from 1 in 17·21 to 1 in 70 persons, the fewest deaths being in the hilly tracts. It must be considered, however, that the spasmodic cholera was raging in the country in that year, and that the deaths from that unaccountable and dreadful malady in two turruffs amounted to nearly 5 per cent., and in one turruff to 6 per cent. of the whole population. It is to be presumed, therefore, in the absence of cholera, the births would exceed the deaths, as was in fact the case in some of the Mawuls, or hilly tracts, where it was known the cholera did not penetrate. In deaths the Moosulmans were the greatest average sufferers, (1 in 20·15) and the low casts were the least sufferers, (1 in 42·94).

As Dr. Walker found that the cholera in the city of Ahmednuggur increased the usual deaths 0·66 per cent., the loss being 2·48, while the cholera raged, and only 1·82 per cent. when the scourge ceased, it is but fair to infer that such would have been the case in the country at large; and this element, applied to the mortality in the Poona Collectorate, would reduce the annual loss to 2·01 per cent., or one death in 50 persons, which would indicate a greater degree of healthiness than all France, all Belgium, or the town of Glasgow, the loss in all these places being 1 in 39 and a fraction.

Marriages.—The average number of marriages in the Poona Collectorate is proportionably more than in England and France, being 1 in 125·87 souls; the proportion in England being 1 in 128, and in France 1 in 130·4 inhabitants. The range in the different turruffs is from 1 in 40·11 to 1 in 493.77; but in 14 turruffs the average is considerably un-

* The deaths in the kingdom of Naples for 1836—37 was 1 in 37 and a fraction.

der that for England. The Shoodruhs (Mahrattas proper) and Moosulmans are almost identical, in their proportional number of marriages, namely, 1 in 116·21 and 1 in 116·86, and they have the greatest number of marriages; the low casts have the fewest marriages. The births in 1826 being only 4954 and the marriages 1998, the average of children to a marriage was 2·48 or not quite 2½. In France the average is 3·72 children to a marriage; in England and Wales 3·55. In Java the births were 1 in 39, deaths 1 in 40 persons.

The constituents of the population in the different collectorates were

	Constituents of the Population.				
	Brahmans.	Rajpoots.	Shoodruhs, &c. Mahratta Cultivators, &c.	Atee Shoodruhs or low casts.	Moosulmans.
Poona..........	Per Cent. 11·58	Per Cent. 0·41	Per Cent. 73·85	Per Cent. 9·78	Per Cent. 4·38
Ahmednuggur...	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.
Khandesh.......	5·40	3·47	69·58	14·72	6·38
Dharwar........	4·48	0·60	74.53	11.895	8·495

In the above analysis the chief features are the permanent and nearly equal proportions of the Shoodruhs or Mahratta cultivators and other genuine Mahrattas, which obtain in the different collectorates; the fact being, that three-fourths of the population are of that most useful class the Shoodruhs; and it will be seen by the notice on agriculture, how large a proportion of them are engaged in tillage. In the Poona Collectorate, as might be expected from its having been the chief seat of a Brahman government, there is a considerable number of Brahmans; every ninth person, in fact, being a Brahman. In the other collectorates scarcely one in twenty persons is a Brahman. Genuine Rajpoots are little known in Dukhun, and I should doubt whether or not the 3½ per cent. of Rajpoots, in the returns from Khandesh, should be added to the Mahratta population; who, by the bye, have some pretensions to being descended from the Rajpoots. The proportion of low casts,* men who

* The low casts comprise all that part of the Hindoo population which cannot claim to be Shoodruhs, such as Mahrs, Dhers, Maangs, shoemakers, skinners, Ramoosees, Beruds, and Bheels. The Mahrs and Dhers are the scavengers, the Maangs, executioners; shoemakers and skinners speak for themselves; the Ramoosees and Beruds are *born* thieves, or are thieves by cast, and they are usually employed for the protection of villages, on the principle of setting a thief to catch a thief. The Bheels are supposed to be the aborigines of the countries where they are found.

are only engaged in vile or discreditable offices by the natives, although otherwise employed by the British, does not differ very much in the different collectorates; the increase in the Khandesh collectorate is attributable to large tracts of the country being inhabited by Bheels, who are a low cast; in fact, less than every seventh person is a low cast; in Poona about every tenth, and in Dharwar about every eighth. The Moosulmans are few in number in the Poona and Ahmednuggur Collectorates, not being one-twentieth of the population in the first, nor one-fifteenth in the second; but, in the Dharwar Collectorate they displace the Brahmans, and amount to nearly one-eleventh. Although the Moosulman power has been paramount nearly throughout all India for centuries, it is believed they have never constituted one-fifteenth of the whole population. In the abstract of the population returns from the Ahmednuggur Collectorate, the casts are not distinguished; but, in a return of 1828, from the city of Ahmednuggur, the Hindoo inhabitants are distinguished from the Moosulman; and it is found that there is the very unusual proportion of one Moosulman to 3·45 Hindoos, or 29 per cent. of the whole population. This is to be referred to the fact of Ahmednuggur having once been the capital of the Ahmed Shahee dynasty of Moosulman kings; with these exceptions, although I have not detailed returns to guide me, I believe that the constituents of the population of the Ahmednuggur Collectorate do not differ in their proportions from those of the Poona Collectorate. In the census of 1822, the families in the fifteen pergunnahs in the Ahmednuggur Collectorate, with a population of 409,279 souls, were enumerated, and it appeared that there were 4·53 persons to a family. With respect to the styles of building in the Ahmednuggur Collectorate, it will be fully illustrated by the facts, that the *tiled* houses amount only to 10·84 per cent. of the whole; the thatched houses to 32·27 per cent.; and the mud flat-terraced houses to 56·89 per cent.

Bearing in mind the clouds of horse that covered the Dukhun in the war of 1817, it is sufficiently remarkable that in 1822, in the whole Collectorate of Ahmednuggur there were only 405 full-grown horses, 1298 full-grown mares; the total, including colts and fillies, being only 2500; the ponies amounted to 12,632, of all kinds.

Proportions engaged in agriculture.—In 1828, in this collectorate, 1878 British villages contained 41,948 cultivators or farmers, and a population of 512,818 souls, and allowing five persons to a cultivator's family, 40·89 per cent. of the people were engaged in agriculture. In Poona there were 52,668 farmers, being a per centage of 55·50, with five persons to a family. In Dharwar 60,701 cultivators, being a per centage of

41·76*, and in Khandesh 44·608 cultivators, being a per centage of 53·16 occupied in agriculture. It is to be understood these proportions have reference to the population of British villages only, and not to the whole population of each collectorate. Moreover, as these proportions are derived from the registered farmers only, and as they are in the habit of sub-letting their lands, I have no hesitation in expressing my opinion that exact returns would prove that three-fourths of the population are directly engaged in agriculture. In the Poona Collectorate, families were not enumerated, excepting in the return from the city of Poona, and here families average 4·82 persons; each house in Poona averaged 6½ persons; but, for the whole collectorate 4·79 persons to a house; so that it is probable the returns of the number of houses would give the number of families. In Khandesh the proportion of inhabitants to a house falls short of the other collectorates, being only 3·96 persons. In Dharwar the number is 4·48 to a house, for the whole collectorate; but the towns exhibit other figures; namely, Belgaon 5·24, Chabee 5·78, and Gunness Pait 5·77 inhabitants to a house; England and Wales has 5·60. The average inhabitants to the square mile, in the different collectorates, has been noticed under the head of civil divisions; and the fewness will disappoint European expectations; but there is plainly a great mistake in the common estimation of the denseness of the Indian population. Bengal proper is said to have 203 inhabitants to a square mile, and Orissa, in the cultivated parts, agreeably to Mr. Stirling, the commissioner, has 135; but, for the whole area of Orissa, the average is only 14½ inhabitants to the square mile; England has 192.

Southern Jagheerdars.—The Southern Jagheerdars have 917 villages, with an *estimated* population of 263,236 souls.

Rajah of Sattarah's territories.—The Rajah of Sattarah, in his territories, has 1703 towns and villages, with an estimated population of 488,846 inhabitants.

With the data in my possession I am enabled to give an estimate of the population of the late Peshwa's territories in Dukhun; it affords a closer approximation to the truth than has hitherto been obtained.

* Including some returns of alienated villages, an estimate makes it 48 per cent.

Collectorate.	Towns and Villages.	Explanations.	Number of inhabitants.	Total inhabitants in each Collectorate.
Ahmednuggur.	1655½	The census of 1822, in the Ahmednuggur Collectorate, in 1655½ towns and villages, exclusive of the city of Ahmednuggur, each village averaging 263·47 inhabitants, gave..	453,098	
	223	223 British villages of Talooks, Kurmulleh, and Korteh, from which population returns were not received, averaging 263·47 souls, give.......	58,753	
	586½	586½ alienated towns and villages, from which returns were not received, averaging 267·47 souls, will give	154,525	666,376
	23	Depopulated villages		
	2488	Total villages in the Ahmednuggur Collectorate.		
Poona Collectorate.	895½	In the collector's revenue statement for 1828 there appeared 1469½ British villages; viz. 895½ towns and villages inclusive of the city of Poona, which sent in population returns in 1826, the villages averaging 226·10 inhabitants, exclusive of the population of the city, give	283,567	
	212½	212½ alienated villages sent in population returns	48,048	
	56 4	56 alienated towns and villages, and 4 British villages, did not send in returns, averaging a population of 226·10 souls each....................	13,566	
	574	574 British villages of the Sholapoor sub-collectorates did not send in returns, averaging by estimate 226·10 souls each..............	164,294	
		Had the average number of inhabitants to a village in the Ahmednuggur collectorate been used as an element, the result would have been 151,145		
	155	155 alienated towns and villages of the Sholapoor sub-col-		

Collectorate.	Towns and Villages.	Explanations.	Number of inhabitants.	Total inhabitants in each Collectorate.
		lectorate at 266·10 souls each	40,838	550,313
	29	Depopulated villages.		
	1926	Total towns and villages in the Poona Collectorate.		
Khandesh Collectorate.	1968	In the collector's revenue statement for 1828, there were 2697½ villages; of this number, 1968 British towns and villages sent in population returns in 1826, averaging 187·39 inhabitants to a village, equal to	368,781	
	64	64 villages, refused returns, at 127 souls each.......... ...	8128	
	330	330 villages are cultivated, but not inhabited, making a total of 2362 villages.		
	335½	To make up the number in the collector's revenue statement therefore, 335½ villages must be added as having become populated since the population returns were sent in, at 127 souls each......	42,608	
	14	14 Jagheer villages sent in returns......................	2623	
	300½	Jagheer, or alienated villages, did not send in returns, at an average of 187·39 souls each..............................	56,317	478,457
	654	Depopulated villages, lands not cultivated.		
	3666	Total towns and villages in the Khandesh Collectorate.		
Dharwar Collectorate.	1899	In the collector's revenue statement for 1828, there appeared 2279 towns and villages; of this number, 1899 British towns and villages sent in population returns, averaging 348 inhabitants to each village............ ...	660,852	
	225	225 British villages in the talooks of Cheekoree and Munowlee did not send in returns; estimating their population		

Collectorate.	Towns and Villages.	Explanations.	Number of inhabitants.	Total inhabitants in each Collectorate.
		from the revenue they yield, falling as a poll-tax as in other parts of Dharwar, there are . .	65,805	
	155	British depopulated villages, lands under cultivation.		
	230	Alienated villages sent in population returns..........	79,727	
	137	Alienated villages did not send in population returns, at the lowest average of population, 236·30 each...........	32,373	838,757
	88	Deserted villages, lands not under cultivation.		
	2734			
Southern Jagheerdars' lands.	917	The area of the Southern Jagheerdars' territories is 2978·125 square miles at 88·39 inhabitants to the square mile, the lowest average of the Dharwar Collectorate gives by estimate..................	263,236	263,236
Rajah of Sattarah's territories.	1703	1703 towns and villages under the Sattarah government, with an estimated population of 287·05 inhabitants to a village, which is the mean between Dharwar and Ahmednuggur, will give...........	438,846	488,846
	12,155	Populated villages.		
	1,279	Depopulated villages.		
	13,434	Total.		3,285,985

ABSTRACT OF THE ABOVE.

Collectorate or Territory.	Area, square miles.	Number of Towns and Villages.	Population.	Average to the square mile.	Average to a village for the whole Collectorate	Average to a house.
Poona	8281	1926	550,313	66·45	* 247·36	4·79
Ahmednuggur.......	9910	2488	665,376	67·24	† 263·47	4·89
Khandesh..........	12,527	3666	478,457	38·19	178·39	3·96
Dharwar...........	9122	2734	838,757	91·94	336·7	4·48
Southern Jagheerdars.............	2978	917	263,236	88 39	287·05	Not known
Rajah of Sattarah's territories.........	6169	1703	488,846	79·25	287·05	Not known.
Total..............	48,987	‡13,434	3,285,985	67·07	270·34	

Average number of inhabitants to a village for all the collectorates, 270·34.

The above population does not include the army, camp followers, Bheels, or the wandering tribes.

It would appear there are 1279 uninhabited villages in the four collectorates of Dukhun, principally in Khandesh; making a total of 10,814 towns and villages in the British possessions, and of 13,434 in the late Peshwah's territories in Dukhun; exclusive of those belonging to the Kolapoor state.

Total alienated villages in the four collectorates, 1695½. Total British populated villages, 7839½; total deserted, 1279. Total villages in the *four collectorates*, 10,814.

Education.

Education, as a regular system, is certainly unknown amongst the people in Dukhun. The few schools existing are wholly disproportioned in number to the population; and even were they more numerous, the present general poverty of the Koonbees,§ and the imperious calls upon them for the services of their children in agriculture, and in attending their cattle, would disable them from letting their children profit by instruction, even though gratuitous. In a stage of civilization which is by

* Exclusive of the population of the city of Poona.

† Exclusive of the population of the city of Ahmednuggur.

‡ Of this number, 1279 are depopulated, and the depopulated villages of the Southern Jagheerdars and Rajah of Sattarah's territories are not known to me.

§ Mahratta cultivators.

no means contemptible, the general illiterateness of the cultivators is remarkable. It might have been supposed that the pressure of the inconveniencies and the risk of loss attending the solving their constantly recurring arithmetical computations, whether in settling their assessments with government, in ascertaining the amount of their produce, or in computing its saleable rate to ensure a profit, or in their money transactions with each other, would have stimulated some families of the past or present generations to have pursued steadily a course of instruction for their children, which, by its example and the visible beneficial results attending it, would have originated a thirst of knowledge, and advanced the march of intellectual improvement. The Shoodra, however, is led to believe by the wily Brahmans that letters and science are not within his province, and the farmer is content to go on mastering his arithmetical difficulties with the assistance of his fingers, and relying upon the village clerk for the keeping his accounts with the government, and on his ability, judgment, and secrecy in the management of his private correspondence, which, it may be supposed, will not be very important or voluminous. Were it ascertained, I believe not one cultivator in a hundred would be found able to write, or count up to 100 but by fives; and my daily unreserved intercourse for hours with numbers of this class of persons has given me facilities for forming this opinion. And yet the Koonbees are far from wanting intelligence; they are not slow in observing; they are quick in communicating, and the rationale of an agricultural process is frequently explained with a simplicity and effect which we might not always meet with in the educated English farmer. There would not be any difficulty in teaching the Koonbees, provided the instruction were gratuitous, and that the farmer could spare his children; and several important effects might attend this instruction: the mind of the cultivator would be invigorated with new ideas; enlarged views of action would break in upon him; a spirit of improvement, enterprise, and innovation might spring up, in place of the apathetic routine that at present prevails in rural œconomy and in the social relations of life; and an amelioration, both physical and moral, would take place in his condition. But at present the little education that exists is confined to the Brahmans and to the shopkeepers, Shaitees*, and Mahajuns.†

The Koolkurnees‡, or accountants and village-clerks, are always Brahmans; many of them are shrewd and very quick, and possessed of infi-

* Heads of trades. † Bankers.

‡ Village clerks and accountants.

nite ingenuity in avoiding the detection of a fraud or mistake in their papers ; many of this class, however, I found too stupid to keep an individual's account, much less the complicated details of a village assessment. The shopkeepers being generally people from Goojrat, keep their accounts in the Goojratee language. The character in universal use for business is the Mohr in the districts. The following will show the number of schools, as far as the returns received from the collectors will permit,—not any account of schools was received from the collector of Ahmednuggur. In the Collectorate of Dharwar there is one school to 2452 inhabitants ; in Khandesh there is only one school to 4369 souls ; and, in the Poona Collectorate, deducting the population of the city of Poona, there is one school to 3337 souls. It is fair to infer therefore, that as Dharwar supports proportionably so many more schools than the other collectorates, that information is more generally spread amongst the people, and that they are better able to manage their affairs than others less instructed ; and the breadth of cultivation, and general manufacturing and commercial industry of the people, would seem to justify the inference.—*Report of the Seventh Meeting of the British Association for the advancement of Science.*

(To be concluded in our next.)

X.—Proceedings of Societies.

Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.

Wednesday, 30*th January* 1839.

PRESENT.

The Honourable Sir Robert Comyn, *President in the Chair*

A. F. Bruce, Esq.
Robert Cole, Esq.
John Carnac Morris, Esq.
Rev. F. Spring,
Rev. W. Taylor,
and
J. Minchin, Esq. *Secretary.*

The Secretary submitted to the Meeting, statements of the Society's accounts for the past year.

Abstract Statement of the Funds of the Madras Literary Society and Auxiliary of the Royal Asiatic Society from the 1st *January to the* 31*st December* 1838.

	Disbursements			Receipts.		
Balance in favour of the Society as exhibited in the Statement submitted to the annual General Meeting held on the 31st January 1838	....	..	..	909	8	11
Total amount of Subscriptions received from the 1st January to the 31st December 1838	....	..	..	4875	11	7
Difference of interest in favour of the Society as stated in Messrs. Binny and Co.'s account closed on the 31st December 1838	....	..	..	22	8	0
Messrs. Binny and Co.'s commission on amount of receipts	48	12	1			
Remitted to Messrs. Wm. H. Allen and Co. booksellers	3130	6	10			
Pay of the Establishment	1594	10	0			
Postage	92	7	0			
Stationery	41	2	0			
Cooly hire	13	11	0			
Sundries	61	11	3			
Expenses incurred in binding books	35	8	5			
Subscription and postage for the Bombay Courier, &c	77	15	0			
Subscription and postage for the Bengal Herald, &c	23	12	6			
Books purchased at Madras	129	8	0			
Paid for printing advertisements, &c	29	0	0			
Paid Messrs. Ouchterlony and Co for salvage charges, &c. on one parcel of books saved from the wreck of the *Royal William* at the Cape	46	8	8			
	5325	0	9	5807	12	6
Deduct disbursements				5325	0	9
Balance in favour of the Society				482	11	9

Abstract Statement of the Funds of the Asiatic Department.

	Disbursements			Receipts.		
Balance in favour of the Society as exhibited in the Statement submitted to the General Meeting held on the 31st January 1838....	....	..	..	979	8	0
Total amount of Subscriptions received from the 1st January to the 31st December 1838.	....	..	..	1106	10	8
Amount realized by the sale of the Madras Journal of Literature and Science........	....	..	..	*1265	8	0
Difference of interest in favour of the Society as stated in Messrs. Binny and Co.'s account closed on the 31st December 1838...	....	..	..	26	15	5
Messrs. Binny and Co.'s commission on amount of receipts......................	23	11	7			
Paid for printing the 18th, 19th, 20th and 21st Nos. of the Madras Journal of Literature and Science............................	1376	12	0			
Pay of the Establishment........	798	0	0			
Sundries..................................	47	0	6			
Paid Freight, &c. on four boxes of books to London................................	25	11	0			
	2271	3	1	3378	10	1
Deduct disbursements				2271	3	
Balance in favour of the Society..................				1107	7	0

The following donations having been made to the Society since the last annual general Meeting, the thanks of the Society were unanimously voted to the donors :—

10 Copies of Ancient and Modern Alphabets of the Southern Peninsula of India,........................Madras Government.

2 Copies of Mr. Bruce's Report on the Manufacture of the Black Tea.................................. ditto

5 Copies of Mr. Turnour's Mahawanso............... ditto

Reports of a Committee for Investigating the Coal and Mineral Resources of India.......................J. Prinsep Esq.

Khazanat ul ilm or the Treasury of Science..........Bengal Asiatic Society.

A Catalogue of Sanscrit books........................ ditto

Auber's Rise and Progress of the British Power in India, 2d vol..Madras Government

Result of the Madras Observations for 1836 and 1837.... ditto

5 Volumes of Reports on the Poor Laws............Captain F. Senior.

Recollections of the Deccan..........................Captain T. J. Taylor.

Fort St. George Gazette for 1832, 1833 and 1834.......J. C. Morris, Esq.

Government and Commerce of India................. ditto

Hodgson on the Law and Police of Nepál............. ditto

* Amount since realized and remitted to Messrs. Binny and Co. from the sale of the Journal Rupees 343.

Reeve's English and Canarese Dictionary	College of Fort St. George.
Morris's English and Teloogoo Dictionary 1st vol.	ditto
Brown's Verses of Vémana	ditto
Reeve's Canarese and English Dictionary	ditto
Cural and Naladiyar (Tamil)	ditto
Cadamunjari (Tamil)	ditto
A Snake preserved in a bottle	Z. Macaulay Esq.
A large beetle called the Bharine purugu	C. P. Brown Esq.
A mutilated Jain image	Lieut. Newbold.
Notice sur des Vêtements avec des Inscriptions Arabes, Persanes et Hindoustani—par M. De Tassy	The Author.
Notice du Traité Persan sur les Vertus De Huçaïn Waïz Kaschifi, intitulé Akhlaqu—i Muhcini—par M. De Tassy	ditto

It was announced that the following gentlemen have been elected members of the Society since the last Annual General Meeting :—

J. C. Wroughton, Esq.
C. R. Howard, Esq.
A. F. Arbuthnot, Esq.
J Cadenhead, Esq.
Dr. Murray,
Lieut. W. T. Nicolls,
Lieut. G. Balfour,
E. C. Heywood, Esq.
A. J. Cherry, Esq.
Major Alexander,
Rt Rev. The Lord Bishop of Madras,
Rev. A. C. Thomson,
Lt. Gen. Sir Jasper Nicolls, K. C. B.

During the past year the Society have lost 18 members by death, retirement or departure for Europe.

It having been ascertained that the name of Baron Von Hammer, who was several years ago elected an Honorary Member of the Society, has been inadvertently omitted from the list—it is

Resolved, that his name be duly entered, and that a letter of explanation be addressed to the Baron on the subject.

The Meeting proceed to elect three members for the Committee of Management for the ensuing year, in succession to the Rev. F. Spring, Walter Elliot Esq. and R. Cole, Esq. who go out by rotation: when Dr. Murray was duly elected, and the Rev. F. Spring and R. Cole Esq. re-elected.

Moved by the Honourable Sir Robert Comyn and seconded by J. C. Morris Esq.—That the thanks of the Society be given to the Rev. W.

Taylor for the manner in which the 2d and 3d volumes of the Restored Mackenzie Manuscripts have been prepared for the Society, and bound at his own expense—Carried unanimously.

The Rev. W. Taylor being present returns thanks.

Read letter from Lieut. Newbold, enclosing copies of manuscript inscriptions from the Ceded Districts.

Resolved, that the thanks of the Society be given to Lieut. Newbold, and that the inscriptions be referred to the Committee of Papers.

The Secretary to the Committee of Papers in the Asiatic Department announces that the Committee has associated with him, as joint Secretary, C. P. Brown, Esq. of the Civil Service, who undertakes that office to the Class of *Oriental Literature;* while he will continue to officiate in the *Physical Class.*

The business of the Meeting being concluded, the thanks of the Meeting were unanimously voted to the Honourable the President for his able conduct in the chair.

(Signed) J. MINCHIN.
Secretary.

(Signed) ROBERT COMYN.
President.

XI.—*Horary Meteorological Observations made agreeably with the suggestions of Sir* John Herschel, *at the Madras Observatory*—*By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

Time	Barmo.	Thermometer. Dry.	Thermometer. Wet	Direction of wind.	Strength.	Remarks.	
Dec. 21							
6 A. M.	30.106	71.1	68.0	——	calm	Flying clouds to the south.	
7 ,,	30.116	71.6	68.6	——	calm	do.	do.
8 ,,	30.150	73.7	70.6	N. W.	1	do.	do.
9 ,,	30.159	76.4	70.6	E. N. E.	2	Clear.	
10 ,,	30.158	78.1	70.9	Do.	2	do.	
11 ,,	30.136	78.2	71.0	N.	2	Flying clouds.	
12 ,,	30.108	78.9	71.0	N. E.	1	Clear.	
1 P. M.	30.082	79.4	70.9	E.	2	do.	
2 ,,	30.064	79.9	71.0	N. E.	2	do.	
3 ,,	30.054	79.8	71.0	E. N. E.	2	Flying clouds.	
4 ,,	30.050	79.8	70.5	N. E. N.	2	do. do.	
5 ,,	30.058	78.8	70.5	N. E. N.	2	do. do.	
6 ,,	30.068	77.2	70.1	N. E.	1	Clear.	
7 ,,	30.076	76.4	69.7	N. E.	1	do.	
8 ,,	30.092	76.0	69.6	N. E.	1	Flying clouds.	
9 ,,	30.102	75.9	69.4	N. E.	1	do. do.	
10 ,,	30.100	75.7	69.0	N. E.	1	do. do.	
11 ,,	30.094	75.5	68.5	N. E.	1	do. do.	
12 ,,	30.086	74.9	68.5	——	calm	do. do.	
1 A. M.	30.074	74.5	69.4	N. E.	1	do. do.	
2 ,,	30.058	74.4	69.3	N. E.	1	do. do.	
3 ,,	30.050	73.6	67 5	N.	1	do. do.	
4 ,,	30.050	72.8	68.0	N. W.	1	Clear.	
5 ,,	30.048	72.0	68.0	N. W.	1	Flying clouds.	
6 ,,	30.064	72.0	68.0	N. W.	1	do. do.	
7 ,,	30.088	72.3	68.6	N. W.	1	do. do.	
8 ,,	30.118	72.7	69.5	N. W.	1	Clear.	
9 ,,	30.140	74.6	70.7	N. W.	1	Clear.	
10 ,,	30.132	76.5	71.0	N. W. N.	2	Flying clouds.	
11 ,,	30.124	77.8	70.0	N. E.	2	Flying clouds.	
12 ,,	30.098	78.4	70.9	N. E.	1	Clear.	
1 P. M.	30.078	79.4	70.7	E.	2	do.	
2 ,,	30.062	79.9	70.8	N. E.	1	do.	
3 ,,	30.051	80.0	71.0	N. E.	2	Flying clouds.	
4 ,,	30.058	79.9	71.0	N. E.	2	do. do.	
5 ,,	30.064	79.0	70.5	N. E.	2	Clear.	
6 ,,	30.076	78.0	71.0	N. E.	1	do.	

Horary Meteorological Observations made at the Summer Solstice, 1838, *at the Trivandrum Observatory.—By* J. Caldecott, Esq.

Date.	Hour.	Wrench's bar. corrected for temp. 32° and for capillarity.	Standard ther.	Dep. of W. B. Ther.*	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
June 21	6 A. M.	29.800	74.0	1·3	72.13	N W	2	No observations—on account of the Actinometer being out of order.	Sky obscured with thick cum.—cold wind.
	7	.807	75.0	1.1	73.43	N by W	2		do. at 7h. 30m. heavy rain.
	8	.808	77.5	1.2	75.83	N by W	2		Zenith clear; bank of cum. in N. W. horizon.
	9	.821	80.0	3.2	75.90	W	2		Fl. cl.; do. at 9h. 30m.—heavy rain.
	10	.824	80.5	2.9	76.49	S by W	6		Sky covered with cum. at 10h. 30m. do. with thunder.
	11	.839	75.8	2.5	72.21	N W by W	7		do. strong cold wind.
	Noon.	.822	75.9	1.8	73.34	N W	2		do. light cool air.
	1 P. M.	.800	76.8	2.1	73.83	N N W	2		do. do.
	2	.788	79.3	1.8	76.81	N N W	2		do. at 2h 30m rain.
	3	.778	77.5	2.4	74.12	N W	6		Somewhat clearer— fresh breeze.
	4	.766	78.3	1.7	75.95	N W	2		Cloudy and threatening.
	5	.780	79.2	3.3	74.58	W	4		do. do. at 5h. 30m. rain—cold wind.
	6	.791	76.8	2.7	72.95	W	5		Sky covered with nimbi—raining do.
	7	.820	75.3	1.4	73.30	N N W	3		do. do.
	8	.834	75.2	1.1	73.64	N N W	2		do. do. slightly.
	9	.844	75.5	0.8	74.37	——	0		do. calm.
	10	.864	75.5	0.9	74.23	N N W	3		do. at 10h. 15m. rain.
	11	·880	74.5	1.9	71.75	N W	10		do. rain with strong wind.
	Midn.	.880	74.0	0.4	73.43	N W	8		do. do. do.
„ 22	1 A. M.	.858	77.8	5.2	70.20	do	2		do do.
	2	.859	74.4	1.1	72.86	do	2		do. do. (slightly) lightn. in S. W.
	3	.839	74.2	1.1	72.62	N W by N	2		do. do
	4	.829	74.0	0.7	73.00	N W by W	2		do. do. lightn. in S. W.
	5	.818	74.5	0.9	73.22		0		do· calm.
	6	.833	74.4	1.3	72.53	N W by W	1		do a rain-bow at sun-rise, at
	7	.855	73.6	1.2	71.86	N W by W	1		do. [at 6h.30m. heavy rain.
	8	.865	75.3	1.2	73.59	N N W	4		do.
	9	.871	77.1	1.4	75.14	N N W	3		do.
	10	.911	77.3	2.8	73.33	W N W	12		do. raining with strong wind.
	11	.926	73.0	1.9	70.20	N W	8		do. do. fresh breeze.
	Noon.	.921	73.3	1.6	70.96	N W	6		do. raining slightly,—modr. breeze.
	1 P. M.	898	74.5	1.6	72.19	do	4		do. do. do.
	2	.851	77.0	2.7	73.16	do	3		Clearing gentle breeze.
	3	.816	77.0	3.0	72.71	N by W	4		Rather clearer do.
	4	.817	76.6	2.7	72.74	N W by N	2		Flying clouds light do.
	5	.807	76.5	1.7	74.10	——	0		Sky again obscured calm.
	6	.824	76.5	2.8	72.49	W	2		do. raining slightly, light breeze.

* Rain prevailed so much throughout these 36 hours, that these depressions indicate the temperature of the rain, rather than the hygrometric state of the atmosphere.

June 21st fall of rain from 6 A. M. to 6 P. M. 1·38
do 6 P. M. to 22d 6 A. M. 1·59
June 22d fall of rain from 6 A. M. to 6 P. M. 1·88

Total in the 36 hours 4.85 inches

The instruments are the same, and situated exactly as before.

Horary Meteorological Observations made at the Autumnal Equinox 1838, *at the Trevandrum Observatory.—By* J. CALDECOTT, Esq.

Date.	Hour.	Newman's Standard bar. corrected for temp. and capillarity.	Standard ther.	Depress. of W. B. thermometer.	Dew point.	Direction of wind	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky, and remarks.
Sept. 21	6 A. M.	29.704	73.0	2.1	68.89	,,	,,	0.8	Zen. clear—cum. about hor. calm.
	7	.727	75.6	2.9	71.40	,,	,,	3.0	do. do. do.
	8	.745	79.1	4.1	7[illegible].29	N W	3	7.3	do. do. gentle wind.
	9	.761	82.1	6.1	73 52	W N W	6	2.5	Obscured. do.
	10	.759	84.0	7.9	72.85	do	4	0.5	do. do.
	11	.751	84.3	9.7	70.30	do	1	7.0	Fl. clds.—cum. about hor. light air.
	Noon.	.728	85.4	10.3	70.60	do	1	12.0	do. do. do.
	1 P. M.	.705	82.0	8.4	69.77	S W by W	1	0	Sky obscured with thick cl. do.
	2	.704	82.8	8.1	71.18	do	2	5.5	Clearing gentle wind.
	3	.693	83.9	9.6	70.00	W by S	2	8.5	Zen. clear—flying clouds do.
	4	.697	81.8	8.1	70.03	do	2	0	Cloudy and threatening do.
	5	.673	80.5	6 3	71.45	do	2	0.5	Clearer do.
	6	.698	79.2	5.9	70.64	S W	1		do. do.
	7	.722	78.4	4 4	72.10	N W	1		Light clouds in zen—cum. about western horizon light air.
	8	.741	78.1	4.0	72.38	,,	,,	No observations.	Drizzling and threatening calm.
	9	.777	77.8	3.7	72.51	,,	,,		do. do.
	10	.805	77.0	2.9	72.86	S W	3		Raining moderate breeze.
	11	.807	76.5	2.9	72.34	do	2		Overcast and threatening do.
	Midn.	.799	76.0	3.4	71.06	do	1		do. do. do.
,, 22	1 A. M.	.730	74.6	1.7	72.15	do	1		Raining almost calm.
	2	.711	73.6	1.2	71.86	W N N	2		Overcast at 2h. 45m. drizzling.
	3	.706	73.5	1.2	71.76	N W	1		Zen. clearing wind cold.
	4	.703	73.5	0.9	72.20	do	2		Clear do.
	5	.753	73.5	0.9	72.20	do	2		Overcast again.
	6	.759	73.5	1.2	71.76	do	1		do. at 6h. 45m. drizzling a rainbow.
	7	.758	74.5	0.9	73.22	do	1	3.2	Zen. clearing—otherwise cloudy.
	8	.782	77 9	2.6	74.24	W	2	5.0	Zen. clear—haze about horizon light breeze.
	9	.795	80.0	4.9	73.06	do	3	4.0	Light clouds about E. hor. otherwise cloudy moderate do.
	10	.789	82.0	6.1	73.41	do	2	5.0	do. do. do.
	11	.757	84.0	8.6	71.75	W S W	3	12.8	Quite clear do.
	Noon.	.750	85.2	9.6	71.52	W by S	4	12.0	do. wind increasing.
	1 P. M.	.706	86.3	10.9	70.68	do	8	11.1	do. fresh breeze.
	2	.787	86.0	10.0	70 15	do	8	8.1	do. do.
	3	.674	85.4	10.5	70.27	W S W	9	1.1	do. do.
	4	.673	84.5	9.4	72.23	do	8	1.9	Flying clouds in zen. do.
	5	.698	82.6	8.5	70.30	S W	4	0.2	Clear in the zen. clouds about S. horizon gentle breeze.
	6	.727	80.5	6 9	70.49	W	4	,,	do. do. do.

The barometer is a Standard one by Newman (having an half inch tube) which has lately been received in excellent order—it is placed in the situation of the former one. The other instruments are the same as before.

September 21st fall of rain from
6 A. M. to 6 P. M. None
do. 6 P. M.
to 22d to A. M. .1010
September 22d do.
6 A. M. to 6 P. M. None
Total in the 36 hours.0.1010 inches.

Horary Meteorological Observations made at the Winter Solstice, 1838, at the Trevandrum Observatory.—By G. Sperschneider, *Superintendent.*

Date.	Hour.	Newman's Standard bar corrected for temp. and for capillarity.	Standard ther.	Depress of wet bulb thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky, and remarks.
Dec. 21	6 A. M.	29.757	67.4	7 9	53.70	N E by N	3		Sky clear—cum. about the N. E. horizon gentle wind.
	7	.799	69.0	8.3	54.87	do	4		do. do. cold wind.
	8	.815	7 .0	9.4	58.61	do	1	4.6	do do. wind hardly percept.
	9	.817	79 5	13.2	57.95	N E	2	6.0	do. do. do. just perceptible.
	10	.802	82.5	15.4	57.38	do	3	7.5	do. do gentle wind.
	11	.783	83 8	15.4	59.15	E N E	2	4.5	do. clear, cum. about the E. hor do.
	Noon.	.753	85 9	16.9	58 81	W	1	2.0	do. do. nearly calm.
	1 P. M.	.729	86 4	14.5	64.20	S W	5	5.8	do. do. gentle wind.
	2	.705	85.8	14.7	63.04	S W by S	10	6.1	do. do. pleasant brisk gale.
	3	.692	85·2	13.9	63.77	S W	10	2.5	do. strata in the N. do.
	4	.704	84.4	12.9	64.64	S by W	8	1.5	Sky clear do.
	5	.716	82.6	12.5	63 09	S W	1	No observations.	do. wind hardly percept.
	6	.724	80.6	10.7	63 93	,,	,,		do. nearly calm.
	7	.732	79.3	9 8	63.99	,,	,,		do. do.
	8	.747	77.0	8 1	64.30	,,	,,		do. do.
	9	.769	75.5	9.2	61.85	N	1		do. wind hardly percept.
	10	.779	72.4	5.0	64.47	,,	,,		do. calm.
	11	.776	70.6	3.8	64.54	N E	1		do wind just perceptible.
	Mid.	.761	71.0	4.2	64.30	do	1		do. do.
22	1 A. M.	.752	69.0	3.4	63.54	do	2		Sky pretty clear cold wind.
	2	.737	68.5	3.4	63.04	do	2		do. do.
	3	.736	67 0	2.9	62.31	,,	,,		do. calm.
	4	.736	67.0	4 4	59.77	N E	3		do. do.
	5	.750	66.5	5.3	57 65	N E by N	4		do. do.
	6	.761	66.2	5.3	57 33	N N E	4		Sky covered with light clouds do.
	7	.781	67.7	5.8	58.11	do	1	1 3	do. wind hardly perceptible.
	8	.791	73 4	8.6	59.27	do	2	2.5	do. do. just do.
	9	.810	78.9	14.1	59 38	do	1	6.0	do. wind hardly do.
	10	.805	82.4	15.3	57.45	N N W	1	9.0	do. do.
	11	.782	84 3	17.0	55.50	N	1	9.5	Sky clear, do.
	Noon.	.748	86.8	19.3	55.05	S W	2	12.5	do. wind just perceptible.
	1 P. M.	.716	87.5	19.2	56.25	do	3	6 7	do. gentle wind.
	2	.695	87.5	18.8	57.08	do	3	3.8	do. do.
	3	.686	8 .7	17.2	59.22	W	3	4.5	do. do.
	4	.689	85.6	16.5	59.21	do	2	3 3	do. do.
	5	.722	84.1	14.8	60.60	W S W	1	2.5	do. do.
	6	.741	81.4	12.3	61.94	W	1		do. do.

No thunder, lightning nor rain throughout.

The instruments are situated exactly as before.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF OCTOBER, 1838.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind 10 A. M.	Direction of Wind 4 P. M.	Direction of Wind 10 P. M.	Weather 10 A. M.	Weather 4 P. M.	Weather 10 P. M.	Remarks.
1838	Inch.	Inch.	Inch.	°	°	°	°	°	°										
Oct. 1	29,990	29,902	29,962	85,7	91,0	83,6	5,8	7,5	4,1	....	....	....	SW	SE	SE	Clear	Clear	Clear	Lightning.
2	,980	,904	,968	86,8	91,0	84,3	7,6	8,0	4,0	....	....	....	W	SE	SW	Clear	Clear	Cloudy	Do.
3	30.004	,934	30,012	87,9	87,7	86,0	9.6	7,7	5,1	....	....	2,476	W	EbySE	SW	Cloudy	Cloudy	Cloudy	Thunder and lightning.
4	,036	,960	,044	86,2	86,0	84,6	5,9	5,5	4,2	....	....	....	S	S	W	Fl. cl.	Cloudy	Cloudy	Do. Do.
5	,060	,976	,038	86,3	89,4	84,5	9,1	5,9	4,5	....	0,321	....	W	EbySE	S	Clear	Th. hz.	Cloudy	Do. Do.
6	,064	,976	,038	86,3	92,0	82,6	7,5	10,0	3,3	....	....	....	N	SE	SE	Fl. cl.	Clear	Clear	Do. Do.
7	,056	—	,030	86,0	—	82,0	6.3	—	3,6	....	....	....	SE	—	S	Fl. cl.	—	Clear	— Do.
8	,038	,990	,040	85,5	87,6	82,5	6,5	9,1	4,6	....	....	....	SW	SEbyS	SE	Clear	Clear	Clear	— Do.
9	,046	,990	,040	84,8	87,8	83,5	7,1	8,8	7,3	....	....	....	NW	E	SE	Fl. cl.	Clear	Clear	— Do.
10	,040	,976	,034	85,3	87,6	80,7	8,1	10,1	5,2	....	....	2,646	E	E	E	Fl. cl.	Clear	Clear	Dew —
11	,046	,970	,028	84,7	87,8	81,8	6,7	10,0	4,8	....	....	....	S	E	E	Clear	Th. hz.	Clear	Lightning—dew
12	,034	,950	,008	85,7	87,4	83,4	10,0	8,3	5,1	....	....	....	S E	E	E	Fl. cl.	Clear	Clear	Do. Do.
13	,038	,964	,016	85,8	86,5	84,5	6,1	7,8	5,4	....	....	....	E	E	E	Fl. cl.	Th. hz.	Clear	Do. —
14	,016	—	29,992	81,2	—	81,2	4,2	—	4,2	....	0,347	....	SW	—	NE	Cloudy	—	Fl. cl.	Do.
15	,012	,952	,986	79,5	81,0	79,2	2,2	6,0	2,5	....	0,397	....	N	NW	N	Cloudy	Cloudy	Cloudy	Do.
16	,008	,942	,970	78,6	76 6	78,5	3,4	3,7	3.7	0,087	0,437	....	N	N	NW	Cloudy	Dr.rain	Cloudy	Do.
17	29,922	,892	,916	78,1	81,0	78,3	4.1	8,2	4,7	....	....	1,539	SW	W	SW	Cloudy	Cloudy	Cloudy	—
18	,964	,882	,930	81,8	85,8	80,7	7,9	10,5	4,6	....	....	....	W	SW	SW	Haze	Th. hz.	Haze	—
19	,960	,900	,956	83,7	86,5	83,8	8,0	8,5	2,8	....	....	....	W	S	S	Clear	Clear	Fl. cl.	—
20	30,000	,940	30,000	84,2	87,6	83,9	6,2	9,1	3,3	....	....	....	SW	S	S	Clear	Cloudy	Clear	
21	,046	—	,044	84,8	—	84,8	5,6	—	1,8	....	....	....	W	—	S	Clear	—	Cloudy	Lightning
22	,096	30,056	,086	85,1	85,6	82,5	7,1	7.1	3,5	....	....	....	SE	SE	SE	Haze	Cloudy	Fl. cl.	—
23	,106	,026	,100	83,9	86,5	82,7	6,4	8,5	6,3	....	....	....	SW	E	SE	Fl. cl.	Cloudy	Fl. cl.	—
24	,010	,028	,062	83,3	85,0	82,0	6,8	10,0	8,0	....	....	2,301	NE	NE	NE	Fl. cl.	Clear	Haze	
25	,074	,000	,024	84,0	85,0	80,3	9,7	9,8	5,6	....	....	....	NE	E	N	Clear	Clear	Clear	Lightning to the east.
26	,022	29,974	,000	81,7	84,0	82,5	6,2	10,0	6,5	....	....	....	NE	NE	N	Cloudy	Cloudy	Cloudy	Thunder and lightning to the E.
27	,018	,[illegible]48	29,994	79,3	81,6	79,5	1,1	—	3,5	1,174	0,467	....	N	—	N	Dr.rain	—	Dr.rain	Do. Do.
28	,008	—	,998	78,6	—	79,3	2,1	—	3,0	0,367	0,535	....	NNE	—	N	Do.	—	Fl. cl.	Lightning.
29	,036	,960	30,018	78,6	80,0	78,7	1,3	2,5	2,0	0,147	....	....	N	N	NW	Do.	Cloudy	Cloudy	Do.
30	,068	,990	,056	79,0	79,4	78,2	2,2	2,9	2,0	0,934	0,117	....	E	N	N	Cloudy	Cloudy	Cloudy	Do.
31	,040	,980	,024	78,7	79,6	79,4	1,5	2,6	1,7	0,944	....	1,550	N W	N	N	Th. hz.	Cloudy	Fl. cl.	—
Mean	30,027	29,962	30,013	83,3	85,4	81,9	5,9	7,6	4,2										

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF NOVEMBER, 1838.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Direction of Wind.			Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.		10 A. M.	4 P. M.	10 P M.	10 A. M.	4 P. M.	10 P. M.	
1838	Inch.	Inch.	Inch.	°	°	°	°	°	°										
Nov. 1	30,016	29,978	29,990	80,4	82,5	78,5	3.4	5,0	2,1	0,217	....	....	NE	NE	Calm	Cloudy	Fl. cl.	Clear	Heavy dew.
2	,008	,958	30,000	80,7	83,8	79,9	2,7	6,8	4,2	....	....	....	NW	NE	NE	Cloudy	Haze	Haze	Dew.
3	,008	,954	29,998	81,4	84,0	80,3	3,4	5,5	2,0	....	....	....	NW	NW		Fl. cl.	Fl. cl.	Dr. rain	Thunder and lightning.
4	,024	——	30,000	78,0	——	78,9	2,0	——	1,0	0,667	0,167	....	NE	——	NW	Rain	——	Do.	Lightning and thunder.
5	29,990	,930	29,976	77,6	76,2	76,4	1,9	1,7	2,2	5,009	0,637	....	N	NW	N	Cloudy	Cloudy	Do.	Squally ——
6	,948	,910	,906	76,5	77,0	76,5	0,8	1,6	1,7	1.382	0,994	....	NE	NW	N	Cloudy	Rain	Calm	Drizzling rain—heavy rain.
7	,920	,876	,91[illegible]	77,7	79,8	78,4	1,3	3,8	1,4	4.700	....	1,304	SW	SE. E	E	Cloudy	Th. hz.	Clear	Vivid lightning.
8	,952	,890	,940	80,7	81,8	79,1	3,2	3,8	1,9	0,067	....	....	E	E	NE	Fl. cl.	Cloudy	Cloudy	Do. and one loud and terrific
9	,956	,902	,958	80,1	82,0	79,9	2,2	4,0	2,5	3,825	0,037	....	E	E	NE	Cloudy	Cloudy	Fl. cl.	Lightning. [crash of th.
10	30,034	,914	30,000	78,2	79,0	78,3	3,2	3,0	1.1	1.044	0,067	....	E	E	NW	Cloudy	Cloudy	Dr. rain	Lightning.
11	,033	——	,003	78,8	——	79,8	0,8	——	1,4	1,534	0,107	....	N. NW	——	N	Cloudy	——	Fl. cl	Thunder and lightning.
12	,063	,964	,028	78,2	79,4	78,3	1,7	1,9	1,9	0,127	0,147	....	E. SE	E	N	Rain	Cloudy	Cloudy	Do. Do.
13	,076	,990	,064	81,8	81.4	79,7	3,3	4,9	3,2	0,247	....	....	NE	E	NE	Fl. cl.	Cloudy	Clear	Lightning.
14	,090	30.000	,090	81,6	79,9	79,7	3,9	3,9	2,5	....	....	1,066	NE. E	NE. E	NE. E	Fl. cl.	Cloudy	Rain	Thunder and lightning.
15	,124	,006	,068	77,5	79,9	78,3	1,5	3,4	2,2	0,187	0,377	....	N	N	NE	Cloudy	Dr. rain	Clear	Lightning.
16	,102	,002	,088	81,1	80,5	79,5	3,3	4,0	2,9	....	....	....	NE	NE	NE	Fl. cl.	Cloudy	Fl. cl.	Do.
17	,110	,022	,078	80,8	80,8	79;3	5,0	5,8	4,3	....	....	....	NE	NE	NE	Clear	Fl. cl.	Fl. cl.	——
18	,076	——	,076	78.8	——	77,7	5,1	——	2,7	....	....	....	——	——	NE	....	——	Clear	——
19	,067	,012	,056	79,5	79,4	77,6	7,1	6 9	4,7	....	....	....	E	NE	N	Fl. cl.	Fl. cl.	Haze	——
20	,030	29,958	,003	78,2	80,0	78.0	5,7	2,0	1,7	....	....	....	N	N	Calm	Fl. cl.	Fl. cl.	Th. hz	——
21	29,982	,940	29,952	76,3	78,8	74,7	4,3	2,3	2,3	....	....	1.620	N. NW	N	Calm	Th. hz.	Th. hz.	Clear	Heavy dew.
22	30,014	,960	30,006	76,9	79,6	76,0	4,6	10,1	3,5	....	....	....	N. NW	NE	Calm	Th. hz.	Th. hz.	Haze	Do. Do.
23	,062	,974	,033	77,2	79,5	73,5	4,9	6,5	4,5	....	....	....	W	NE. E	Calm	Haze	Haze	Clear	Do. Do.
24	,088	,985	,035	76,4	79,5	76,0	5,5	7,5	6,3	....	....	....	N	NE	NE	Clear	Clear	Clear	Do. Do.
25	,077	——	,054	77,2	——	75,7	6,2	——	5,7	....	....	....	E	——	N	Clear	——	Clear	Do. Do.
26	,100	30,004	,086	77,3	78.0	76,3	5,3	6,5	3,3	....	....	....	N	NE	NE	Cloudy	Cloudy	Cloudy	——
27	,112	,046	,126	79,1	80,4	77,3	4,1	5,9	2,3	0,147	....	....	NE	E	NE	Fl. cl.	Fl. cl.	Fl. cl.	——
28	,156	,072	.140	76,3	79,0	78.2	1,8	4,0	3,9	0,091	....	1,990	NW	NE	NE	Fl. cl,	Cloudy	Fl. cl.	——
29	,126	,042	,124	79,0	78,8	76,5	4,7	4.8	2,1	....	....	....	N	E. NE	E. NE	Fl, cl.	Dr. rain	Rain	——
30	,120	.042	,114	78.3	78,8	77,5	4,2	5,3	4,9	0,117	....	....	N. NE	N. NE	NE	Cloudy	Cloudy	Fl. cl.	——
Mean	30,049	29,974	30,030	78,7	80,0	77,9	3,6	4,6	2,9										

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY ; FOR THE MO[illegible]

1838	Barometer at			Ther. at			Wet Bulb.			Rain.			Direction of Wind.			Weather.			Remarks.
Days.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.	Evaporation.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	
	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Dec. 1	30,105	30,016	30,072	77,8	78,5	75,7	6,3	9,0	7,3	......	......	......	E N E	N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	
2	,086	——	,068	76,0	——	76,1	5,6	——	3,1	......	......	......	N W	——	N W	Fl. cl.	——	Cloudy	
3	,058	29,990	,008	77.8	78,8	77,8	3,8	4,4	2,3	......	......	......	N. N W	N. N W	N	Haze	Cloudy	Cloudy	
4	,016	,944	29,978	78,7	79,8	76,7	3,5	4,8	2,4	......	......	......	N W	N W. N	N	Fl. cl.	Fl. cl.	Cloudy	
5	29,968	,924	,944	76,1	78,0	76,4	2,2	3,0	1,8	0,190	0,317	1,958	N	N	N	Rain	Cloudy	Cloudy	[night thr. & lig.
6	,930	,874	,906	75,1	76,5	75,7	1,5	2,1	1,1	1.781	0,232	......	N. N W	N. N W	N. N W	Rain	Rain	Cloudy	Strong wind or light gale at
7	,893	,910	,993	75,8	76,8	76,7	0.7	1,8	0,7	1,634	0,067	......	W. N W	S	S E	Rain	Cloudy	Cloudy	Lightning.
8	30,084	,988	30,050	78.8	81,0	77,8	1,5	4,0	1,7	......	......	......	E. S E	S E	E. N E	Fl. cl.	Fl. cl.	Fl. cl.	Do.
9	,062	——	,050	78.8	——	77,7	2,8	—	4.6	......	......	......	N E	——	N E	Fl. cl.	——	Fl. cl.	Do.
10	,090	30,004	,198	78,7	80,0	77,8	4.0	6,0	4.6	......	......	......	E	E	N	Fl. cl.	Fl. cl.	Fl. cl.	——
11	,120	,042	,112	78 6	78,6	76,6	4,6	5,1	3,0	......	......	......	S E	N. N E	N	Fl. cl.	Cloudy	Clear	——
12	,126	,042	,104	77,7	78,6	75,4	2,3	3,6	2,3	......	......	2,063	N	N E	N	Fl. cl.	Fl. cl.	Clear.	Dew.
13	,116	——	,070	77,8	——	76,3	3,2	—	2,0	......	......	......	N	——	N E	Fl. cl.	——	Fl. cl.	Do.
14	,080	——	,064	78,3	——	76,8	3,4	—	2,2	......	......	......	E	——	N	Fl. cl.	——	Fl. cl.	Do.
15	,116	30,010	,119	78,5	81,4	78,3	2,9	6,4	2,3	......	......	......	E	N E	N	Fl. cl.	Fl. cl.	Fl. cl.	Do.
16	,152	——	,142	79,8	——	78,0	3,7	—	4,4	......	......	......	E	——	N E	Fl. cl.	——	Clear	Do.
17	,192	,104	,150	75,7	80,0	77,1	6.7	9,5	7.0	......	......	......	E. N E	E. N E	N E	Fl. cl.	Fl. cl.	Clear	Do.
18	,150	,074	,134	78,1	79.0	76,0	6,8	8.0	6,1	......	......	......	E. N E	N	N E	Clear	Clear	Fl. cl.	Do.
19	,128	,064	,132	76,9	78.5	74,4	5,5	7.5	5,1	......	......	1,027	N E	N E	N E	Cloudy	Haze	Clear	Heavy dew.
20	,150	,064	,140	75,6	78,5	75,3	4.9	8.0	4.9	......	......	......	N W	N E	N	Fl. cl.	Fl. cl.	Fl. cl.	Do. do.
21	,158	,050	,100	78,1	79.8	75,7	7,2	9,3	6,7	......	......	......	E. N E	N E. N	N E	Clear	Fl. cl.	Fl. cl.	Dew.
22	,132	,058	,146	76,5	79,9	75,6	5,5	8,9	5,1	......	......	......	N W. N	N E	N	Fl. cl.	Fl. cl.	Fl. cl.	Heavy dew.
23	,134	——	,112	76,8	——	75,0	6,1	—	6,1	......	......	......	N W	——	E	Fl. cl.	——	Fl. cl.	Dew.
24	,138	,066	,104	77,1	79,4	75,9	7.1	8,4	6,1	......	......	......	N E	N E	N E	Fl. cl.	Fl. cl.	Clear	Heavy dew.
25	,124	——	,112	75,7	78.0	74.8	4.8	8,0	3,3	......	......	......	N. N W	N E	N	Fl. cl.	——	Fl. cl.	Dew.
26	,140	,083	,157	78,0	78.0	76.9	4,0	8.0	4.4	......	......	1,227	N by E	N E	N E	Cloudy	Fl. cl.	Fl. cl.	——
27	,158	,082	,121	78,0	78,0	78.0	4.0	3,9	2,5	......	......	......	N	N E	N E	Clear	Showry	Cloudy	
28	,170	,058	,120	77.5	83,0	77,8	3,5	8.5	3,6	......	......	......	N by E	N E	N E	Clear	Fl. cl.	Fl. cl.	
29	,178	,084	,160	78,0	78,8	76.8	4,8	4,1	6,0	......	......	......	N E	N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	
30	,174	,080	,134	77,5	79,0	77,7	4,0	7,0	3,7	......	......	......	N E	N E	N N E	Fl. cl.	Fl. cl.	Fl. cl.	
31	,138	——	,092	77,7	——	78,2	4.1	—	4,2	......	......	......	N. N E	——	N E	overcast	——	Clear	
Mean	30,106	30,028	30,087	77.6	79,1	76.7	4.2	6,2	3.9										

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about 5 feet above the surface of the ground, and 27 feet above the level of the Sea.

The barometer employed is No. 1, one of two Standards which I had constructed at the end of the year 1836, to supply the place of those broken during the storm: the indications set down are those immediately read off from the instrument, and consequently require in addition to the ordinary correction for temperature, the correction +,051 for capillarity: from a late comparison of these with a magnificent standard by Newman which had been constructed with all the advantages of modern improvement for the Trevandrum Observatory, it appeared that when *corrected for capillarity*, the

Trevandrum Standard stood at		30,000	inches.
the Madras	No. 1	30,001	do.
	No. 2	29,993	do.

The thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard:

	h.	*m.*	*s.*	
Longitude	5	21	8	E.
Latitude	13°	4	8,5	N.

T. G. Taylor,

H. C. Astronomer.

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 23—*April* 1839.

I.—*Notes on the Duty of Government in periods of Famine.—By* John F. Thomas, Esq. *Madras Civil Service.*

(Continued from the last Number page 78).

This enquiry,* which on a more extended examination of the subject I would confine to famine alone, is one at all times of such extreme importance to the people, and has acquired so much additional interest from the present circumstances of part of the Northern Circars, that I am induced to prosecute it more at length. I am anxious also to avoid a misconstruction to which the former remarks† are, I fear, liable; that because I am disposed to question in the present state of Southern India the reasoning, and the principle of the circular order of 1833, deprecating any interference on the part of Government; I would therefore advocate an opposite course; and recommend a constant and general tampering with the grain trade of the country. This is far from my intention. The sole question I would raise, is the propriety of Government interference at periods of great exigency,—at those times only, when the drought has been general over large tracts of country, and there has been a failure of the standard crops throughout a whole province—when, in fact, we have either cause

* See former brief observations No. XXII. p. 78, viz. "Whether there are not, as Dr. Smith seems from his guarded language to admit, means open to the Government, which may not be improper for it to adopt in periods of drought, by which that most dreadful scourge, the absolute famines which now periodically desolate our provinces, may be wholly prevented, and scarcity at all times greatly mitigated, without a departure from sound general principles, and at no great charge on the finances of the State."

† See No. XXII. pp. 71-72.

to dread, or are experiencing famine with all its fearful destruction of life and property; such as has been witnessed in our provinces in 1807, in 1823-24, and recently in 1832. I need scarcely add, that it is further still from my views, to propose any measures for fixing, or regulating the price of grain, or similar arbitrary interference with the freedom of the grain merchant. Such measures, there can be no doubt must be injurious, by impeding the traffic in grain generally; but above all, by preventing that frugal use of the stock in hand, without which it would be impossible for the people, at periods even of partial scarcity, to escape all the horrors of famine.

In entering upon this investigation it is of great moment, that the real practical question for examination should be distinctly brought before us, it appears to me that it may be fairly stated in these terms. Is it the duty of the Government in periods of drought, to look on as at present, almost passively, whilst thousands and tens of thousands of the population are swept off in a few months: or, are there now safe, and legitimate means of interference within its power, through which it can secure much larger supplies of food for the people, than they could otherwise obtain, and thereby lessen the mortality of famine? It is only when the question is put in this form, and we keep in view, the enormous waste of life and of national wealth in this country in seasons of severe drought, that the subject is placed in its true light.

During the drought in Guntoor in 1832 there are grounds to conclude, that more than one third of the inhabitants of the district, or upwards of 200,000 persons perished, in a population of little more than 500,000, within a short period. The returns of population in the year prior to the famine, give 512,000, in the year subsequent, but one half or 255,000, and four years later, but 267,000, and it is asserted that there was little or no emigration.

Population of Guntoor.

Fusly....1241	512,517
1242	255,511
1244	267,714

Previous famines have also been estimated to have destroyed one third of the inhabitants of those districts, in which drought was general. And we might perhaps fairly assume this proportion, as the ratio of mortality in famines in India, when they are left to work out their natural effects unchecked. In examining therefore the present system of non-interference, under which the people depend solely on private enterprize for additions to their stock of food, the loss of life throughout the whole population must be calculated at this rate; and we might probably also safely estimate the loss of the labourers of a

province, including men and women, at a higher average, for it is upon this class, that famine presses with such peculiar severity.

If this ratio, either of loss of life or of labour be considered too high, one much lower may be assumed, and the magnitude of the evil will still be readily admitted; and it will also I believe be admitted, that if the Government could afford relief without serious detriment to any class of society, and without involving its finances in inextricable difficulties, it would be both its duty, and its interest to give this relief.

This brings us immediately to the consideration of the arguments of Dr. Smith, and other great authorities, which go to shew, that a Government has no power to afford relief in such emergencies,—that its interference must do harm, and further,—that its interposition is uncalled for, as all available aid will best be rendered by the operation of self-interest, inducing the private trader to throw in additional supplies of food for his own profit :—and that non-interference is consequently the only sound policy of a state.

The validity of this doctrine in the circumstances of Europe, may be readily granted. Nor do I see, that Dr. Smith's arguments can be shaken on a single point, when applied to countries like Great Britain in an advanced stage of society, and situated within the temperate zones: which are never visited by absolute famine, as the effect of the season alone, but only by scarcity. But I hesitate, without further and more full investigation, to acknowledge its truth in respect to South India; for much of the reasoning of Smith appears to me inapplicable to this, or to any tropical country in an early stage of civilization. Where, the people are dependent for their food, almost wholly on the periodical rains, and where, as our experience has demonstrated, it is not merely scarcity with which we have to deal, but absolute famine extending at the same moment over immense tracts; and where we must add also,—the resources of the inhabitants are almost as nothing, compared with the resources and means of the inhabitants of Great Britain, or highly civilized European states.

But to proceed to the examination of Dr. Smith's views in detail. On analyzing them, his doctrine of total non-interference with the provisioning of the people, appears to be based chiefly on these grounds. First, that a famine is never the effect of a bad season *alone*, for that occasions only scarcity. Secondly, that it cannot be caused by unjust combinations on the part of the dealers in grain, for their interest is the same with the people. And thirdly, that there are, from facility of inter-communication and other circumstances, resources in Europe available

to the people, which, combined with a frugal consumption, effectually secure them against famine, if there is no interference with the corn trade by the Government.

He first remarks, that though a real scarcity is ordinarily occasioned by the fault of the season alone, a famine is *never* so occasioned; or to give his own words. "Whoever examines, with attention, the history "of the dearths and famines, which have afflicted any part of Europe "during either the course of the present or that of the two preceding cen-"turies, of several of which we have pretty exact accounts, will find, I "believe, that a dearth never has arisen from any combination among the "inland dealers in corn, nor from any other cause, but a real scarcity, "occasioned sometimes, perhaps, and in some particular places, by the "waste of war, but in by far the greatest number of cases by the fault of "the seasons, *and that a famine has never arisen from any other cause, but* "*the violence of Government attempting, by improper means, to remedy the* "*inconveniences of a dearth.*" And he adds, that "the scantiest crop, if "managed with frugality and economy will maintain through the year, "the same number of people that are commonly fed in a more affluent "manner by one of moderate plenty."* It is deserving of notice that throughout, Dr. Smith speaks only of the "inconveniences" of dearth; and never once contemplates apparently, a people in the fearful state of destitution, to which a season of general drought now reduces the population of this country : when if allowed to run its course, famine cuts off one third of the inhabitants, with the great mass of their cattle. For drought in the tropics, does not as drought or excessive wet in Europe, affect only the standard crops of the country; but it is in the expressive language of scripture, "a drought upon the land, and upon the moun-"tains, upon that which the ground bringeth forth, and upon men, and "upon cattle, and upon all the labour of the hands." This utter destruction of all the resources of the people, I apprehend to be the

* "In an extensive corn country between all the different parts of which there is a "free commerce and communication, the scarcity occasioned by the most unfavourable "seasons can never be so great as to produce a famine; and the scantiest crop, if "managed with frugality and economy, will maintain, through the year, the same number "of people, that are commonly fed in a more affluent manner by one of moderate plenty. "The seasons most unfavourable to the crop are those of excessive drought or excessive "rain. But as corn grows equally upon high and low lands, upon grounds that are "disposed to be too wet, and upon those that are disposed to be too dry, either the "drought or the rain, which is hurtful to one part of the country, is favourable to ano-"ther, and though, both in the wet and in the dry season, the crop is good deal less than "in one more properly tempered, yet, in both, what is lost in one part of the country is "in some measure compensated by what is gained in the other."—*Wealth of Nations Book IV chap. V. Digression concerning the corn trade and corn laws.*

true character of Indian droughts;* and I believe it also to be certain, that they do, without any adventitious cause save what may be found in the existing condition of society, of themselves constantly occasion the most desolating famines. If this be denied, and it is contended, as Dr. Smith is disposed, though with some hesitation to contend, that the droughts of India are not so intense, nor so universal as of *themselves* to occasion famine—I would ask, how has it then occurred, that tens and even hundreds of thousands have perished by actual starvation under British rule, whilst it is certain, that there has been no tampering on the part of Government with the grain trade of the country, and the people have been left to the freest use of their own resources. In opposition to Dr. Smith's supposition "that the drought is scarce ever so universal as necessary to occasion a famine if the Government would allow a free trade." I should maintain, that no fact is now perhaps better established in Indian statistics,—that not scarcity, but absolute famine in all its severity, is caused by the fault of *the season alone*, and that it is not brought on by any improper regulations on the part of the Government.†

Should this be conceded, it appears to me to strike at the root of the doctrine of non-interference in tropical countries, and consequently that we are not warranted in applying, as the circular order of Government does, Dr. Smith's principle without limitation to Southern India: but must confine its application to cases, similar in their character to scarcities in Europe. To seasons for example of very partial drought or of dearth, where, either from the previous stores of grain in the pits of

* The difference between the bad season of the tropical and the temperate zone, is strongly marked in the following report of the out turn of the late bad season in 1838 in Great Britain and Ireland.—*Results of the Harvest in Ireland.* In this country the harvest is at an end, with the exception of isolated mountain districts. The result may be thus shortly stated. Wheat is generally speaking, fully one-third short of an average crop, and the grain is deficient in yield. As far as the farmer is concerned, the price will, to some extent, make up for what is wanting in quality and quantity. But the superabundance of the oat crop is admitted in all quarters and barley and potatoes are, with very few exceptions, also beyond an average crop. In fact, allowing for the partial failure of wheat, this year will be one of the best the Irish farmers have had for a long time. We are much better off than our neighbours either in England or Scotland.—*Dublin Post, Tuesday week.*

† "In rice countries, where the crop not only requires a very moist soil, but where, "in a certain period of its growing, it must be laid under water, the effects of a "drought are much more dismal. Even in such countries, however, the drought is "perhaps, scarce ever so universal as necessarily to occasion a famine, if the Government "would allow a free trade. The drought in Bengal, a few years ago, might probably "have occasioned a very great *dearth.* Some improper regulation, some injudicious "restraints imposed by the servants of the East India Company upon the rice trade, "contributed, perhaps, to *turn that dearth* into a famine."—*Wealth of Nations Book IV chap. V. Digression concerning the corn trade and corn laws.*

the ryots, or from the limited area over which the drought extends (as it is probable is the case at present in the Northern Circars). The means of alleviation, and of staying off famine are accessible to the great bulk of the population.

That Dr. Smith's doctrine can only be justly applied to such cases, will I think be further evident, upon consideration of the arguments advanced in its support by himself and Dr. Chalmers, who has followed out his views at length,* both laying much stress, upon the natural alleviations, or the palliatives to scarcity, at all times within the reach of the people of Europe.

They observe, that the variety of soil and climate greatly modifies the effect of bad seasons, that there are substitutes for the food of man in the grain raised for cattle, (and we might add a certainty in the temperate zone of a supply of water for animal life), that the large amount of the external commerce of the different states of Europe, gives to each a command at all times over the products of the other, and that these, with other alleviating circumstances, amply secure the inhabitant of Europe against absolute famine or starvation. So effective indeed are these palliatives in Europe immediately within the reach of the people, and so dissimilar is European dearth, from Indian or tropical famine; that whilst we number deaths by tens of thousands in a few months, Dr. Chalmers hesitates not to affirm (see his late Bridgewater Treatise. "On the moral and intellectual constitution of man" vol. II. p. 46) "that the country emerges from the visitation of dearth, *without* "*in all probability, the starvation of one individual.*" And again at p. 49. "It is in these various, ways that a country is found to survive so "well its hardest and heaviest visitation, and even under a triple price "for the first articles of subsistence, it has been found to emerge into "prosperity again, without an authentic instance of starvation throughout "all its families." These passages must I think carry conviction of a truth, which I am anxious to establish, of the first importance in this enquiry—that there is nothing parallel in the case under the review of Smith, Chalmers, and other political economists of Europe, to the circumstances before us in India: and I would rest my first objection to the unlimited application of the principle of non-interference in periods of famine in South India, on the manifest dissimilarity between the circumstances of dearth in the two countries.

Should this objection be considered of any weight, we may then be permitted to question, whether the authority of Adam Smith's great name, can properly be thrown into the scale in favour of the doctrine of non-interference, in the peculiar exigency of famine by the fault of the

* See Dr. Chalmers' Political Economy, and his late Bridgewater Treatise.

season alone. And it may also then be open to discussion, whether the general principles of his work lead us to conclude, that it is the duty of a Government at periods of excessive drought, rigidly to abstain from all attempts to increase the quantity of food in the country, or whether it may not by a judicious application of its means, secure enlarged supplies, and lessen the mortality; and the consequent destruction of labour and of capital.

Certain it is, that Malthus* and other writers, who have ranked high as followers of Smith, have maintained, that the provisioning of the country cannot always be safely relinquished to the operation of the ordinary laws of supply and demand, which govern less necessary articles; and that there are considerations affecting the food of a people, which may take it out of the ordinary rules of Political Economy. The case of South India during famine, is, I am disposed to think precisely, one of these cases, requiring therefore to be dealt with under peculiar regulations. And as it is no argument against the corn laws of England, that there is always a compensation for the produce lost by a bad season in our own country, in the abundant crops reaped by our neighbours—unless we are at the same time assured, that that abundance will not be withheld from British ports, from hostile motives or commercial jealousy. So in like manner, it is no argument in favour of non-interference in this country, to urge, that the grain lost by the failure of the monsoon in some one of our provinces, is, in the merciful dispensations of God, invariably compensated by the superabundant crops of other kingdoms, or provinces. Unless it can also at the same time be clearly proved to us, that this excess of produce of the favoured province, will flow into those suffering from drought; and *that, in time* to prevent the destruction of the inhabitants, and with them the very sources of national prosperity. Unless this can be shewn, this peculiar dispensation of God's providence, by which the deficiency of one portion of the world might be supplied from the superabundance of another, is utterly unavailable, for it amounts to nothing to tell us that such extra supply does exist elsewhere, it might as well not exist, if we have not at the same time the assurance, that it will reach those who must perish without it.

We come now to the consideration of another of Dr. Smith's main averments, that this abundance of favoured districts will readily find its way into famine districts, if Government do not interfere. In establishing this

* See Tracts on the Corn Laws.

point he first ably disposes of the objection which might be made to his views, *in limine*, that famine or excessive dearth may be caused by a combination of the dealers to raise the price of corn at the cost of the people. This he shews to be impracticable, and proves that there is an identity of interest between the corn dealer and the consumer, which precludes injurious combination. His argument on this head, I believe to be in a great degree applicable to this country. At the same time it is quite possible under the peculiar circumstances of South India, that cases have occurred, and may again arise, in which the wholesale dealers and importers in our provinces, who are not in danger as in Europe of having their trade encroached upon, have combined to prevent additional supplies of grain being introduced; or, what amounts to the same thing, have remained inactive, with the view of enhancing the value of the stock in hand. But such cases must I should think be very rare, as in general, it is decidedly the interest of the dealers to bring in as large supplies as practicable, and obtain the high prices of scarcity.

But it is not upon this part of Dr. Smith's reasoning that I would remark. It may be readily granted that it is the interest of the dealer to supply the people in times of famine with food, as plentifully as he possibly can; but it is his power,—his ability to do so effectually, in the present condition of this country, that I question.

Dr. Smith assigns the facility of intercommunication between the different provinces of a state, and different countries, as one prominent ground of his opinion, that when a Government does not improperly interfere, the supply of grain will be ample and sufficient to prevent famine. And when the nations of Europe are at peace, and there is nothing to prevent her merchants from a free intercourse with every state, it is no doubt true, that the wants of one kingdom or province in periods of scarcity, will be immediately provided from the stores of others, by the ordinary motives and exertions of self-interest. But I hesitate to make a similar admission in the case of this country, for we must first ask, does this facility of intercommunication now exist in Southern India? And are not the defects and imperfections in the means of communication between the several provinces of this Presidency, and also distant markets, such, as to raise a barrier, which the private merchant cannot now overcome, to the *timely* importation of those large supplies of grain required in districts visited by severe drought. And may it not perhaps be fairly questionable, whether the just inference from Smith's reasoning under these circumstances, is not, that the Government of a half civilized country, of which this defect of intercommunication is the common feature, should

abstain from interference in the emergency of famine; but whether it should not for the time, come forward and afford such aid, as may place her grain merchants in the period of severe drought, as much as possible on a level in the means of communication, with the dealers in more advanced nations, by undertaking part of the labour, and bearing part of the charge of transit.* But whether this be a legitimate inference, or not, it is I think clear, that till there is that facility of intercommunication which Dr. Smith assumes, neither his principle, nor his reasoning can be justly applied to this country.

There can also I think be little doubt, that in laying down his great doctrine of non-interference, Dr. Smith had under consideration, the abundance of capital in private hands, the extensive credit, and the known enterprize, and spirit of adventure in British and European merchants; as well as the intimate connection of the whole mercantile body of Europe; by which, the merchants of London, Liverpool, or Dantzic can obtain with ease, an immediate consignment of corn from each other, or from any quarter, at the shortest notice.† Whilst the large and constant commerce by sea, and the good roads generally throughout European states, remove all impediments to an early augmentation of the food of the country, even from distant markets, whenever scarcity prices shall make this profitable. All these circumstances are, I apprehend, included as the grounds of Dr. Smith's views; and I cannot but think, they differ widely from the actual circumstances of this Presidency. Not only, are the means of intercommunication by land between our provinces very defective; but it must also be allowed, that the maritime commerce of the Presidency is in its infancy;—that the whole

* As an illustration I would propose the question, whether in the event of absolute famine in our provinces bordering on the Punjab, it would be an injudicious interference on the part of Government, at a moment of pressing exigency to offer the native merchant of Bengal and Bombay, the use of the Government steam vessels on the Indus and the Ganges at a low charge, and thus give him the means of introducing supplies in one-fifth of the ordinary time. And whether this increased facility of importation at such a period, and thus raising the country *pro tempore* to a level with more civilized states in the means of intercommunication, would not rather be in accordance with, than a departure from Smith's principles; if care were at the same time taken by bounties, that no merchant should suffer loss by his more tardy importations. Or, to apply the case to the Madras Presidency, would it be an improper act, if the Government were to offer the native merchant at periods of famine, the use of vessels to bring up his grain against the monsoon, when the native craft either could not, or would not move.

† The extensive credit which the European merchant enjoys, is the consequence of the general integrity of the class; and this integrity, not only gives him a command over the capital of others, but secures a faithful execution of his orders in foreign markets. It is, I have reason to believe, the difficulty the European capitalist in this country finds, in obtaining through native agency a similar upright and faithful execution of orders, and supplies of grain of good quality, which keeps him from embarking in the trade, even when large profits are to be made in it.

mercantile body is small, in proportion to the mass of the population, and its capital and credit limited: and that these causes, whatever may be the strength of the motives of self-interest, by which the dealers are prompted, must tend greatly to obstruct, if not to prevent the success of any effort, they may make to supply the urgent, and vast demand of districts visited by famine.

As already observed, the actual fact is, that they do not now in any measure meet this demand, even when supplies have been obtainable with comparative ease; and that grain has not hitherto been introduced by the private merchant in seasons of famine into districts, in time to prevent the starvation of the population. The single fact, *the great mortality of the labouring classes which now takes place in every season of general drought*, appears to me fully to demonstrate of itself, the total inefficacy of private exertion in the present state of South Indian commerce. But to place this point beyond dispute, I annex a table of the prices of grain at Ganjam, Vizagapatam, and the neighbouring provinces throughout the entire period of the late famine in Guntoor. It will be seen from this table, that in the year 1832, whilst tens of thousands were perishing in Guntoor from the want of food and consequent disease, and grain was there more than triple its ordinary price, it was to be had at near markets, with which there was moreover an open sea-communication, at the ordinary rate, or at one-third of the price; and that throughout the whole period of the famine, private enterprize never brought in enough, either to lower the prices considerably in Guntoor, or to raise them much in Ganjam and Vizagapatam. So manifest is it, that the abundance of one district in South India is not now made, through the instrumentality of private exertions, to supply the deficiency of another.

	Guntoor.		*Ganjam.*		*Vizagapatam.*		*Rajamundry.*		*Masulipatam.*	
	Rice	Raggy	Rice	Raggy	Rice	Raggy	Rice	Raggy	Rice	Raggy
Fusly 1231 AD. 1831-2	154	197	50	71	47	60	57	65	59	75
Fusly 1232 AD. 1832-3	200	218	61	87	69	90	102	141	123	184*

If it were possible to obtain them correctly, it would be desirable to add to these facts, data which might shew the limited amount of capital in the hands of the grain merchants, and the low state of trade

* The prices are given for these two important grains for the entire period of the famine, but it is necessary to observe, that Masulipatam also suffered partially from the same drought which afflicted Guntoor, and the high price there, is probably to be accounted for by that circumstance, and not by the supplies, withdrawn for the use of Guntoor.

in general, and from them also to prove the inability of the dealers to meet the extraordinarily large demand of famine. But on these points I must refer to the remarks made in the former part of these notes ;* and I would ground my second and further objection to the application of Dr. Smith's doctrine to this country, upon the facts just adduced. They appear to me to establish this important point.—That how great soever may be the incentive of self-interest, and the intelligence of the mercantile body of this Presidency, there is not now practically, that intercommunication between our provinces or distant markets, which would enable the private dealer (as Dr. Smith assumes) readily to meet the wants of a district suffering from bad seasons; and that if left to private exertion, the country must experience all the horrors of famine every season of general drought. And such accordingly was the case in 1824, when hundreds and thousands perished at Madras and its neighbourhood, although it was then confidently predicted by the first authorities, that if left to himself, the private merchant would bring in ample supplies.

Though I do not think any thing further is required to establish the inadequacy of private effort to meet the exigency of famine, there is a consideration, applicable chiefly to the rural districts of the Presidency, which it may be well to bring under review. In such districts, a difficulty, wholly unknown in Europe, to the timely and adequate supply of food in seasons of famine, arises it is probable from the peculiar condition at this date of South Indian society. Nine-tenths and more of the population of those districts are agricultural, or subsist directly from the land; and a large proportion depends for entire support on the out-turn of the year. The agricultural labourers, the great bulk of the population, do not, as in Europe, receive their wages in money, and obtain their supplies of food from the baker, who has capital embarked in the grain trade, and who procures his corn from a distance or near, as may best suit his interest; but they are paid their *wages in kind*, when the harvest is gathered in, and on that they must subsist through the year. If the harvest fails, whence are their wants to be supplied? It is not, I conceive, in the nature of things, that the petty village grain merchant, whose ordinary traffic is confined to the supply of a few families, by purchases made on the spot, should have a stock in hand to meet the large extra demand of the labouring class, which he could give to them on credit. And even the substantial ryot, when he has no store left from the crops of former years, cannot I should suppose venture to give any aid at such a crisis—so that it may be doubted, unless supplies of grain are introduced by foreign agency, and

* No. XXII, p. 74.

brought to the door of the village chitty, if there is capital, or agency in the district, wherewith the demand of the labouring classes for food, can at such seasons be met. In a society differently constituted, like that of Great Britain, where more than one half of the population are non-agricultural, the labourers, both manufacturing and agricultural can fall back upon their employers; and wherever there is a large manufacturing and commercial class, there also, is a large grain trade, and a body of dealers accustomed to import supplies, who in time of high prices will greatly enlarge their transactions, and the increased demand of the people for *foreign grain* can be met without difficulty. But in the circumstances of the rural districts of this Presidency, I see no means of meeting a like demand; and hence there may be a necessity for Government interference whilst society is in its present condition.

Independently of the several considerations which have been already advanced, I would also remark that it appears necessary to the establishment of Dr. Smith's great principle of non-interference, that all the circumstances to which he adverts should exist combinedly. It is not enough for example, that it is physically true in any country, that scarcity only, and not famine is caused by a bad season; but it must also be established, that there is a total abstinence in that country at the same time from unjust combination by the dealers in corn. For if an unjust combination does exist, then I conclude, the Government must and ought to interfere, for its interference can alone prevent the starvation of the people, even in a period of scarcity. Again, let there be no unjust combination, yet if a facility of intercommunication does not co-exist simultaneously with perfect freedom of trade, and all barriers to the ready transfer of the grain of one province, or one market to another, are not removed; the Government may even in that case, be called upon to interpose, in order effectually to secure the timely introduction of the necessary supplies of food. So that in applying Dr. Smith's principle, we must not look only to specific points; but enquire, whether the circumstances of a country are the same, or very similar *in all points* to those he had under review, before we can recognize the validity of his principle. If the facts in South India are, that in a bad season, instead of scarcity, we have famine, and in lieu of an immense body of traders, too numerous to combine, with abundant capital, and intelligence equal to the greatest enterprizes, we have but comparatively a small body, who can combine, of limited credit and capital, and not ordinarily engaged in distant speculations. And if instead of a facility of intercommunication between the different provinces, and distant marts, there are great impediments existing, not to be readily surmounted by

private effort: then, not only if all these circumstances, but if any one exists, we have not, I am disposed to think, a foundation upon which Dr. Smith's doctrine can be safely erected, and we must question its applicability to this country.

But whilst this, with much of what has been advanced, may be admitted, yet the inference which would follow, that Government interference is called for, may not be conceded; for it will perhaps still be argued, that private exertion, if wholly unfettered, will be found the safest and *best* means of supplying, *even* the greatest and most urgent wants of the people. Or to use Dr. Smith's language "that the natural effort of every individual to better his own condition, when suffered to exert itself with freedom and security, is so powerful a principle, that it is alone, and without any assistance capable of carrying on a society to wealth and prosperity, and of surmounting a hundred obstructions with which the folly of human laws too often encumbers its operations." Book IV. chap. V. Digression, &c. There is so much force in this statement, that if the fact did not stare us in the face, that these natural efforts do not in any adequate measure now meet the case of famine in this Presidency, I should not venture to advocate even the most cautious Government interference; although I think it demonstrable that the reasoning by which the doctrine of non-interference has been hitherto supported, is, so far as South India is concerned, untenable. But so long as famine in this Presidency occasions any thing like the present fearful mortality, and destruction of property, and so long as entire provinces are desolated by a single season of severe drought; it appears almost a moral duty, before we rest satisfied with the present passive system, to institute the fullest enquiry,whether there are not at the command of the Government legitimate means of adding to the food of the country, and thereby lessening the misery and ruin of such periods. I would therefore ask, whether there are solid objections on general principles, to the Government, in the exigency of famine, throwing additional supplies into the market by the instrumentality of the grain merchants themselves, by offering them facilities for their commerce, not accessible to them at other times. In advances of Government capital,—in increased means of transit,—in premiums on importation in the form of bounties, or of return cargoes of Government salt; or similar public aid, which would not tend to supersede, but to stimulate their exertions. Nor am I prepared to allow, that—if the Government went a step further, and imported supplies of foreign grain at its own risk, *not to be brought into the market for sale to compete with* the grain merchant, but to be dealt out as rations to the people driven by extreme poverty to work on the roads,

or other public works—an interference with the provisioning of the people to this extent would be faulty in principle. For this class, it must be remembered, has no means of obtaining food from private sources in exchange for their labour, nor could they without Government aid, become at such times purchasers from the grain merchants. The payment for their labour in kind by rations, could not therefore trench unjustly upon the interests of the dealers, nor lessen the efficiency of the grain trade. And till some experiment of this character has been made, and failed, are we fairly in a position to carry out Dr. Smith's great principle of total non-interference, as the only sound policy of the state, at the sacrifice now periodically made of an enormous waste of life and of national wealth?

And, lastly, even if it shall be found upon the most ample examination, and after judicious experiment, that the magnitude of the evil of drought in this country is such, that the Government cannot safely meddle; from the just fear that it will lead to an undue expectation of relief, and to a less economic and frugal use of the stock in hand; and that any interference on the part of Government with the grain trade however cautiously attempted, paralyzes private effort, and aggravates the general distress, and that the present system is consequently right; there is one means of future alleviation, which might gradually lessen the present amount of evil, still open to the Government. If the well-lands of the country were relieved from taxation, and advances made generally to ryots (as practised partially in South Arcot in 1836) to deepen and enlarge their wells, or to construct new ones, it is probable, that the capability of the country to bear up under the visitation of famine, could be greatly increased, and the permanent resources of the Government proportionally improved. And if it be certain, that no measure for adding directly and immediately to the food of the people in periods of drought is practicable, this would then seem to be the best safeguard against famine with all its present horrors, and national loss; and this measure at least, might perhaps be pressed on the attention of the Government, as an act at once of duty, and of the soundest policy.

MADRAS, *March* 1839.

NATURAL HISTORY

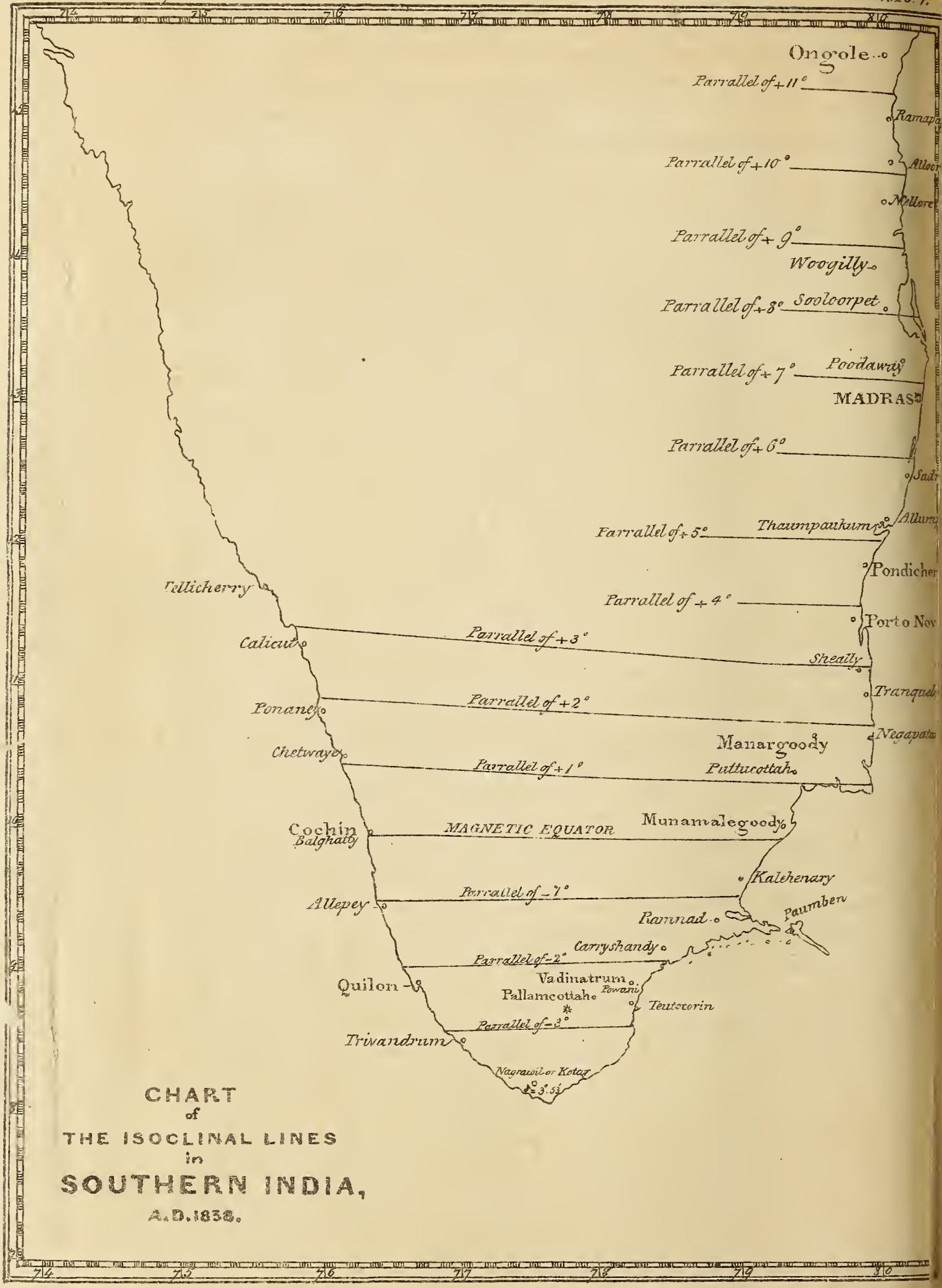


CHART
of
THE ISOCLINAL LINES
in
SOUTHERN INDIA,
A.D. 1838.

II.—*Observations on the Direction and Intensity of the Terrestrial Magnetic Force in Southern India, made by* Thomas Glanville Taylor, Esq. *Astronomer to the Honourable East India Company, and* John Caldecott, Esq. *Director of the Trivandrum Observatory.—Communicated by the former Gentleman.*

As far back as the year 1831, at the suggestion of Professor Kupffer, I had projected making a series of observations upon the magnetic dip and intensity in India; but having failed in procuring the necessary apparatus here, and having been equally unfortunate in an application in England, I was necessarily compelled, *pro temp.* to give up my intention. In the year 1837, having been favoured by Captain Moresby, of the Indian Navy, with the loan of a dipping needle, which had been supplied to him by the Geographical Society of Bombay, for the express purpose of making observations upon the coast of India;* and having, through the kindness of Captain Drinkwater Bethune, R. N., been favoured with the temporary loan of two of the intensity needles, which had been employed in the magnetic survey of Ireland; I determined to employ the former, and to construct some needles of the latter description, wherewith to undertake for India, a series of observations similar to that so ably accomplished in Ireland.

With regard to the plan of observation; the lines of equal dip and intensity in India being nearly parallels of latitude, it was evident that the observations should be made in a line at right angles to these, or along the coast; accordingly I resolved on commencing at *Ongole*, in lat. 15° 12′ N., and proceeding at intervals of 20 or 30 miles along the coast to Cape Comorin (the southern extremity of the Peninsula); and from thence along the western coast to Goa.

To have performed the whole of this by myself, would have taken up more time than could be conveniently spared consistently with the prosecution of my astronomical duties; which determined me to invite the assistance of individuals resident in India, to take a part in the observations. My application was not long in meeting with attention from many in various parts of India; but the aid of only one of these (J. Caldecott, Esq. of the Trivandrum Observatory†) was available to an extent which promised to be useful. Accordingly I lost no time in making

* The Geographical Society of Bombay were pleased, subsequently, to allow me to retain the needles so long as I found occasion for them.

† The Observatory at Trivandrum, having been very lately established, is perhaps at present but little known, but the excellence of its arrangements, and the superiority of the instruments which have been ordered, added to the indefatigable zeal of its superintendent, cannot fail soon to render it an establishment of importance.

arrangements with Mr. Caldecott, as to the parts we should each take in the labour; when it was eventually agreed that I should undertake the observations on the eastern, and that Mr. Caldecott should make those upon the western, coast.

For this purpose I left Madras on the 23d day of July 1837, and proceeded to the southward, making observations every day, at intervals of about twenty-five miles; until on the 2d August I arrived at Tranquebar. Here I was met by Mr. Caldecott, whose zeal in the cause would not allow me to make my own observations unassisted. In the observations for dip, I had hitherto only found time to employ three out of the four needles supplied, viz. Nos. 1, 2 and 3; but the presence of Mr. Caldecott suggested the propriety of employing the remaining needle (No. 4), and of taking a double set of observations. This would have been accomplished, but that a few preliminary trials at Tranquebar with needle No. 4, convinced us of its utter uselessness for the purpose intended, in consequence of the want of roundness of the steel pivots. This discovery led to a minute examination of the other needles; when No. 2, (which had in the course of observation exhibited singularly discordant results), appeared likewise to differ from a cylinder in the form of its pivots. These circumstances naturally led to the rejection of the observations hitherto made with needle No. 2, and the *non*-employment of No. 4 in the remaining parts of the work. But, before proceeding further, I may as well give some

Account of the Instruments employed.

They consisted of a dip apparatus by Gilbert, furnished with four needles (two useless) of 4½ inches in length; a pocket chronometer by Arnold, and three intensity needles. The dipping needles were apparently cut out of flat plates of steel, and were hardened at the ends (see fig. 1); the agate planes, Ys for centering, and levels, &c. &c. differed in no respect from the ordinary construction. The intensity needles I had caused to be constructed here, after the plan of Captain Bethune's, to agree nearly with the model of those of Professor Hansteen; viz. each needle was 2,7 inches in length, and 15 inches in breadth, cylindrical, and rounded at the ends;* they were first turned in a lathe, from pieces of English steel wire, and then hardened by plunging them, when at a pale red heat, into cold water; after which they were softened in the middle by placing them upon a red-hot poker. They were now mag-

*Professor Hansteen's were pointed at the ends.

Fig. 1.

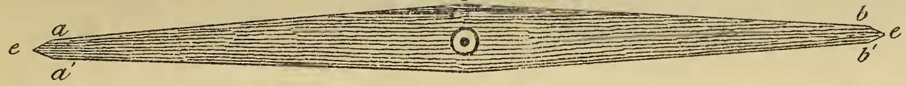


Fig. 2.

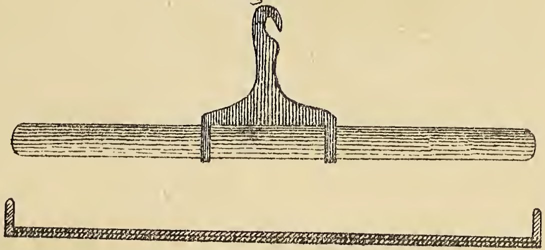
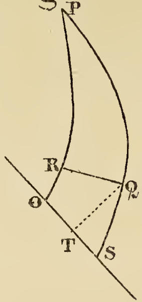


Fig. 3.



netized to saturation by a powerful magnet, and employed during two months previously to my departure, for the purpose of discovering if their intensities remained constant. Each needle was fitted into a brass stirrup (see fig. 2), for the purpose of being attached to a few filaments of untwisted silk, by which it was suspended when in use; and when unemployed, was fitted with an armature of soft iron. When the observation was to be made, the needle was suspended in a square wooden box, of four inches on the side, and 1¼ inches high; the top of this box was fitted with a plate of glass, in the centre of which the end of a hollow glass cylinder of eight inches in length (a piece of broken barometer tube) was cemented; to the upper end of this cylinder, one end of the silk filaments supporting the needle was secured, so as, passing through the cylinder, to leave the needle suspended by the other end at half an inch above the bottom of the box, when its oscillations could be seen through the glass plate at top, or through two glass windows, placed opposite to each other in the sides. At the bottom of the box inside, a line was drawn in the direction of the two windows; and at angles of 20 degrees on either side of this, were drawn two other lines; the centre line being made to correspond with the direction taken up by the needle when at rest (the magnetic meridian), and the other lines, exhibiting azimuths of 20° to the east and west of this, shewing the arcs at which the observations were always to commence. On one side of this box a delicate thermometer was fixed, whose indications could likewise be seen through the glass plate at top. The pocket chronometer by Arnold was one of ordinary goodness; in addition to which Mr. Caldecott had provided himself with a pocket chronometer by Barraud, and an artificial horizon and sextant, for determining the latitudes of places which could not be identified on the map. We will now mention one or two

Particulars with regard to the modes of observing.

Hitherto, it had been my custom to watch the decreasing vibrations of the dipping needle, and register its indication when stationary. Such a mode of observation, however, often led to unsatisfactory results; for, on tapping the apparatus gently, without un-centering the needle, it frequently exhibited an altered position, to the amount sometimes of forty or fifty minutes; and an approximate result only could be obtained, by taking the mean of the readings after repeatedly tapping and re-centering the needle. This circumstance led to an alteration in the mode of observing, which consisted of first centering the needle on the agate planes,

and then, by means of a magnet, causing it to vibrate through an arc of 60° (i. e. 30° on either side of the stationary position). and noting the successive diminishing arcs of vibration of one of the ends; after which the needle was again centered, and the arcs of vibration of the other end similarly read off &c. &c., when the stationary point was obtained by interpolation. Thus at Tranquebar, August 9th, Needle No. 1.—

End A Vibrated from	to	δ =	End B Vibrated from	to	δ =
°	°	°	°	°	°
— 33,9			— 30,9		
	+ 27,0	∴ —2,75		+ 24,3	∴ —2,62
— 31,1			— 28,2		
	+ 24,2	2,77		+ 21,7	2,60
— 28,4			— 25,6		
	+ 21,6	2,75		+ 19,3	2,55
— 25,8			— 23,2		
	+ 19,2	2,70		+ 16,9	2,55
— 23,4			— 20,8		
	+ 16,9	2,65		+ 14,6	2,57
— 21,0			— 18,5		
Mean	=	—2,72		=	— 2,53

and the mean of both readings = 2°, 65 = 2° 39′.

In this way, five or six readings were generally obtained in each of the eight several positions of the needle, and, in addition to this, the readings, when the needle had come to rest, were likewise registered; thus, in the case just cited, the whole of the readings when reduced* were as follows:—

			Readings when at rest.				Readings when oscillating.			
			°	′	°	′	°	′	°	′
Face of Inst. east: axis direct			— 3	35	— 3	40	— 3	4	— 3	10
——	west	———	— 3	5	— 3	5	— 2	52	— 2	57
——	——	invd.	— 3	7	— 3	15	— 3	4	— 3	14
——	east	———	— 3	20	— 3	10	— 2	43	— 2	35

Reversed the poles

* The observations of the needle when vibrating were read off in degrees and *tenths* of a degree, in consequence of the rapidity of the vibrations not affording time to register two figures, which generally would occur in the minutes;—the error of reading very rarely exceeded one-tenth of a degree, or six minutes.

			°	′	°	′	°	′	°	′
Face of Inst. east :	axis direct		+ 8	10	+ 8	15	+ 7	54	+ 8	6
——	west	——	7	10	7	0	7	16	7	3
——	——	invd.	8	15	8	0	7	25	7	17
——	east	——	7	15	7	25	7	4	7	8
The mean =			+ 2° 12′ 52″		+ 2° 11′ 15″		+ 2° 14′ 30″		+ 2° 12 15″	
∴ The true dip of δ =			+ 2° 12′ 4″						+ 2° 13′ 22″	

The above is one case out of many which occur, in which although large differences are found in the several single readings, still the means are coincident; other cases there are, however, in which the means disagree: thus—

		Mean of Readings when at rest.	Mean of Readings when oscillating.	Difference.
At Negapatam Needle No. 1 gave	δ =	+ 2° 46′ 41″	+ 2° 31′ 30″	0° 15′ 11″
—— No. 3 ——	=	1 6 30	1 22 54	0 16 24
Tranquebar No. 3	=	1 47 48	2 11 11	0 23 23

These results from the needles when vibrating appearing invariably more consistent than those derived in the usual way, I have not hesitated to give them the preference, and reject the stationary observations.

The observations with the intensity needles require but little notice here, beyond the mention that they have been uniformly made by noting the time of describing the first, second, and third hundred vibrations, commencing from an arc of 20 degrees on either side of the meridian. Added to this, it only remains to state that the observations both for dip and intensity were uniformly commenced between the hours of 9 and 10 in the morning, and finished at 2 or 3 in the afternoon.—We will now resume our journey.

We left Tranquebar on the evening of the 13th August, and proceeded to the southward, making observations every day (at distances of from 20 to 25 miles), and arrived at Trivandrum on the 26th August. Here we had leisure to examine our observations; and the result of it, as will appear in the sequel, was not so satisfactory as could be wished: it exhibited an uncertainty in the dip observations at several places, to some amount, and the intensity observations were not altogether free from blame. This determined me to re-observe on my return homeward, at those places at which doubtful results had been obtained; and, having met with a clever

workman (in the person attached to the Trivandrum Observatory, for the purpose of repairing instruments, &c.) I procured the re-turning of the pivots of the hitherto useless needles (No. 2 and 4), and the construction of two new intensity needles.

Thus equipped I left Trivandrum on the 20th September, and employing all four of the dipping needles and five intensity needles—which practice had now enabled me to accomplish unassisted—I again made observations at those places which had hitherto given contradictory results; and eventually arrived at Madras on the 15th October.

It had been agreed upon by Mr. Caldecott and myself, that, before completing the observations to the northward of Madras, the instruments should be sent to him, to perform a portion of the work to the northward of Trivandrum; this was done, and the observations, as far as Tellicherry, were made by Mr. Caldecott, in the month of November following. It had been Mr. Caldecott's intention to have completed the series on the western coast at a no very distant date: but the unsatisfactory results now arrived at, induced him to await the arrival of a new dip apparatus and needles from England (which he had ordered of Mr. Thomas Jones for this purpose), and to return the needles to me for the prosecution of the observations on this coast. I was anxious for the completion of the work, but had already been too long absent from the Observatory, whereby computations had accumulated, and observations had been neglected to some extent; thus circumstanced, I availed myself of the services of a very intelligent and careful native (Tannyachellum) who, after making observations on the dip and intensity every day during three months, had acquired as correct a habit of observing as could be expected or desired. Tannyachellum accordingly was despatched from Madras on the 27th April 1838, with directions to make observations of the dip and intensity at distances of about 25 miles apart, from hence, along the coast as far as Ongole; and to re-observe at the same places on his return. This was accomplished by the end of June; and with the exception that the dip observations were made in the usual way, *not by our method of "vibrations,"* I venture to assert that the results he has obtained, are not less accurate than I might have arrived at myself.

The new dip apparatus by Jones, much to our disappointment, did not arrive at Madras till September 1838, just before Mr. Caldecott's departure for England: on examination it appeared in every respect to be a very superior instrument; but the results arrived at here, both by Mr. Caldecott and myself (Mr. Caldecott being at Madras by this time) were

not more accordant than those already obtained from the other needles. Notwithstanding this, Mr. Caldecott, at some considerable inconvenience to himself, repeated his observations with the new needle at Cochin and Allepee, previously to his departure for Europe. I have thought it necessary to mention these particulars, in order to account for having so long delayed fulfilling my promise of giving these observations: but my desire to render the work complete, *even now makes it doubtful if I had not better wait for the observations on the western coast;* but, with thus much by way of apology, and the promise that, at some future, not far distant time, the observations on the western coast will be completed; we may at once turn to the observations, and their discussion: and, since there will be much to say in the way of discussion, it may be as well to leave the intensity observations for the present, and commence the

Discussion of the Dip Observations.

The discordant results which have been met with by Captain Sabine* and others in measuring the dip by different instruments, renders it desirable that a comparison of the needles now used with others should be instituted; accordingly I have availed myself of two observations made here with a dip apparatus belonging to Captain Drinkwater Bethune R. N., and of three observations made with Mr. Caldecott's needles—we get altogether as follows:—

					Dip for Madras. ° ′ ″	° ′ ″
Needle	D. B. No. 1	from 1	observation	δ =	+ 6 55 4	+6 52 30
——	D. B. ,, 2	—— 1	——	=	6 49 56	
——	T. G. T. ,, 1	—— 2	——	=	6 45 22	+6 50 9
——	T. G. T. ,, 2	—— 1	——	=	6 44 13	
——	T. G. T. ,, 3	—— 2	——	=	6 56 56	
——	T. G. T. ,, 4	—— 1	——	=	6 54 4	
——	J. C. ,, 1	—— 1	——	=	6 51 34	+6 52 30
——	J. C. ,, 2	—— 2	——	=	6 53 26	
	Mean	——	——	=	6 51 19	

The discrepancies here met with, probably for the most part arise from error of observation; since only one or two results from each needle have

* In the observations lately made for the magnetic survey of Ireland, there appears, in an extreme case, a difference of 41′ between the results from two of the needles employed.

been obtained: we perceive, that, employing the needles 1 and 3 T. G. T., an error from the mean of a few seconds only would be committed: and that employing 1. 2. 3, and 4, T. G. T. or 1, and 2 J. C., in either case our results would, as far as constant error is concerned—possess nearly the same degree of accuracy as if made from the whole 8 needles.

In the Report of the British Association relative to the magnetic observations made in Ireland, it is mentioned, "of the eight results obtained with needle (P), there is only one which differs from the mean "of the eight by a single minute." Such accuracy, however, cannot be the boast of the Madras observations; for, as it will be seen presently, a *single degree*, instead of a single minute, will occasionally be thrusting itself in between observation and the truth. But, not to be too hasty in statements, it may be as well to mention, that, by reason of the feebleness of magnetic force in India, arising from proximity to the magnetic equator on the one hand, and high temperature on the other, one carefully made set of dip observations under every advantage, cannot be expected to arrive nearer than within 8 or 10 minutes of the truth. On looking over the whole of the results, however, discordances are found to an amount far exceeding this,—one indeed which would render the observations altogether useless, were there no means left of accounting and making allowance for the same. I became aware of the discordances which affect our observations, when at work on their reduction at Trivandrum: at first I felt inclined to attribute the discrepancies to local causes and error, but a little reflection convinced me that I must give up such a supposition, since, from the care we had taken in every particular, the one was highly improbable and the other impossible; for we had been careful to observe in sheds or under trees, far removed from local disturbing causes, and had not omitted to lay aside our keys and the buckles from our stocks and braces, &c.; so that we must look to some other cause for an explanation of the discrepancies.

In the course of our travels, I had noticed at one place (*Carryshandy* I think), that, on applying the magnet to one end of the needle to ascertain the position of the poles, the edge *a* (fig. 1) attracted the needle and *a′* repelled it; but, on again applying the magnet to *a*, its pole had become changed to the same denomination as *a′*; and on immediately vibrating the needle, its inclination had altered about 50 minutes. Having at Trivandrum met with a similar anomaly, I was led to enquire, whether the discrepancies which appeared in some of the observations could not be accounted for in this way: might not the magnet, in the act of reversing the poles, have pressed upon one edge, and have established a pole at *a* or *a′* instead of the end *e*? To resolve this difficulty, I availed myself

of a very bad observation (one in which I had purposely been careless), and one which proved very discordant, to discover, by thrusting the needle among some iron filings, where the poles were situated; when, my discordant observation was fully explained by the poles having chosen to take up a position at *a* and *b*, forming an angle of 1¾ degrees with the ends *e* and *e′*.

I now, for the sake of variety, inclined the magnets a little, so as to establish the poles at *a′* and *b′*, and, as might be expected, a result differing 3½ degrees from that just made, immediately resulted: the former being as much in excess as the latter was in defect.

I now set to work systematically—thus—at Trivandrum August 30th—13th September 1837.—

Needle employed.	Observed dip. ° ′ ″	Remarks.
Needle No. 1 =	—3 17 30	Each result being the mean of 5 observations in one position of the needle only; made with the greatest possible care, that the poles should be setled at the ends *e* *e′*.
—— =	3 20 0	
—— =	3 22 3	
—— =	3 22 30	
—— =	— 4 7 0	Each derived from 5 observations in the same position as above, by causing a slight degree of inclination in one of the magnets, whereby the poles were situated at *e* and *a*.
—— =	4 7 0	
—— =	— 4 56 0	From the mean of 5 observations in the same position as above, magnetized by inclining both magnets slightly, whereby the poles took up the position *b′* and *a*.
Needle No. 4 =	+ 0 22 30	Each result being derived from 5 observations in one position of the needle only, magnetized by causing a slight inclination of both magnets, or poles at *a′* and *b*.
——	+ 0 17 30	
—— =	— 0 37 30	Each result being derived from 5 observations in the same position as above, inclining one of the magnets only, or poles at *e* and *a′*.
—— =	0 37 30	
—— =	0 35 30	
—— =	1 17 30	Each result being determined from 5 observations in the same position as above, both magnets being drawn to the ends; or poles at *e* and *e′*.
—— =	1 17 30	

In a similar way the following were obtained—

	° ′ ″	
Needle No. 3—	3 55 23	Mean of 8 observations, poles at *a* and *b′*
——	3 20 0	—— —— —— *e* and *e′*
——	1 42 30	—— —— —— *a′* and *b*

	° ′ ″		
Needle No. 2—4	7 10	Mean of 8 observations, poles at	b' and a
———	2 22 56	—— ——	—— a and b
———	2 22 43	—— ——	—— e and e'
———	2 28 41	—— ——	—— a' and b'

The above results, being derived from one position of the needle only, do not represent the *true* dip, but furnish, by means of differences, what we require: thus, taking the means—

Needle No. 1 shews—that if the poles, instead of being situated at e, e' should take up a position such as e and a, (which in practice has occasionally occurred) then, the reading would be erroneous to the amount $\pm$ 0°,49′,0″; and that, in an extreme case, when both poles are astray, then an error in the reading to nearly double of this amount (or $\pm$ 1°,35′,23″) results—or, we obtain on the whole.

The Poles being situated at

Needle.	e & e'	a & b	a' & b'	e & {b, b'} e' & {a, a'}	a & b' a' & b
	error. ° ′	error. ° ′	error. ° ′	error. ° ′	error. ° ′
No. 1	0 0			+0 46	+ 1 35
— 2	0 0	0 0	+ 0 6		1 44
— 3	0 0				1 37
— 4	0 0			+0 37	1 37
Mean.	0 0	0 0	+ 0 6	+0 42	+ 1 38

A greater degree of consistency would no doubt exist between these numbers, were the ends of the needles symmetrical, and of exactly the same size; then we should expect to find

		° ′
Poles e and e'	the error of observation	= 0 0
a and b or a' and b'	—— ——	= 0 0
e and b or e and b' / e' and a or e' and a'	—— ——	= $\pm$ 0 49
a and b' or a' and b	—— ——	= $\pm$ 1 38

The greatest disagreement from these being in the case of needle No. 4, (poles at e and a'), I have, since writing the above, turned to

examine it, when the want of symmetry in one of its ends, fully justifies the accuracy of the $\pm 0°,37'$ found above. The other needles are, however, singularly perfect; so that the mean values here found belong to needles Nos. 1, 2, and 3; and for No. 4 as far as concerns the poles a and b' and a' and b; but for the positions e and a' the correction $= -0°.37'$ and we may conclude, for —— —— e and b' —— —— $= +1.\ 1$ and for the remaining positions e' and b and e' and a —— $= \pm 0.49$

In the actual determination of the dip, however, it is necessary to invert the poles: so that putting p and $\frac{p}{2}$ for the corrections which apply to needles Nos. 1, 2, and 3; we may

in one position of the poles of the needle—read off ...... $\begin{cases} A \\ A \pm \frac{p}{2} \\ A \pm p \end{cases}$

and in the inverted position of the poles we might read off . $\begin{cases} B \\ B \pm \frac{p}{2} \\ B \pm p \end{cases}$

where $\frac{A+B}{2} = \delta$ the true dip, or, taking all the possible combinations of these six readings, the values for δ, resulting from either of the needles 1, 2, or 3, and for several cases of No. 4,

			° ′ ″
are	$\frac{A+B}{2}$	or	$\delta \pm 0.\ 0.\ 0$
	$\frac{A+B}{2} \pm \frac{p}{4}$	or	$\delta \pm 0.24.30$
	$\frac{A+B}{2} \pm \frac{p}{2}$	or	$\delta \pm 0.49.\ 0$
	$\frac{A+B}{2} \pm \frac{3p}{4}$	or	$\delta \pm 1.13.30$
	$\frac{A+B}{2} \pm p$	or	$\delta \pm 1.38.\ 0$:—

and since, in the remaining cases of needle No. 4, there are several values entering, which the observations afford no clue to identify, if they are—poles at e and a' or at e and b', it will in cases of doubt be as well to reject the observations of needle No. 4. With this view of the case, and recollecting that among several independant observations,—in the greater number of cases no correction whatever will be necessary—the poles will have identified themselves with the extreme ends of the needle,—we will now consult Table I, and endeavour to discover what proper compensations may be applied to the values there given, to obtain the true values of δ

TABLE I. DIP OBSERVATIONS, &c.

Date.	Place of Observation.	δ Needle I.	δ Needle II.	δ Needle III.	δ Needle IV.	Observed by	Site—Remarks, &c.
1838		° ′ ″	° ′ ″	° ′ ″	° ′ ″		
May 19	Ongole	+11.46.15	+ 11.43.26	+ 10.45.37	+ 11.43. 7	T.	On the bank of the *red* tank, (the village lying on the south, and the traveller's bungalow distant 100 yards to the east) under the shade of a tree.
20	———	11.31.53	11.56.15	11 25.37	12.23.45	T.	
May 16	Ramahpatam	+11.15.37	+ 11.11.31	+ 10.45.37	+ 11.43. 7	T.	In Mr. Elliot's compound,—under the shade of a tree.
23	———	10.36.31	10.35 37	10.46.15	11.26.34	T.	
May 14	Alloor	+10.17.11	+ 10.20.19	+ 9.50.56	+ 10.21.53	T.	In a cadjan shed attached to the tasildar's cutcherry.
27	———	10.17.11	10.26.31	10.16.53	9.50.19	T.	
May 12	Nellore	+10.35.19	+ 9 45.57	+ 9.30.37	+ 9.43.26	T.	In *Singaryah's* garden, under the shade of the banyan tree.
29	———	9.46.15	9.33.26	10.31.53	9.24.23	T.	
May 9	Woojelly	+ 8.23.45	+ 9.11.53	+ 8.49.41	+ 8.43.26	T.	100 yards to the south of the traveller's bungalow, under the shade of a banyan tree.
June 1	———	8.50.37	8.52 30	8.53.26	8.14.41	T.	
May 7	Sooloorpet	+ 8. 6.53	+ 8.10.37	+ 7.27 11	+ 8. 5.56	T.	In the weaver's grove close to the traveller's bungalow.
June 3	———	8.11.34	8.16.34	8.11.15	7.29. 4	T.	
May 28	Poodaway	+ 7.18.26	+ 7.14. 4	+ 7.23.26	7.16.53	T.	Ellamas's grove under a banyan tree
29	———	6.15.56	7.11.53	6.58.45	7.43.26	T.	do. do.
June 7	———	7.10.37	7. 8 45	9. 2.49	6. 0.37	T.	do. do.
1837							
April 26	Madras	+ *6.49.56	+* 6.46.52			D. B. & T. G. T.	In the observatory dwelling house.
26	———	*6.55. 4				D. B. & T. G. T.	Do.
July 17	———	6.49.49		+ 6.54.30		T. G. T.	In the observatory.
Oct. 16	———	6.40.56		6.59.22	+ 6.54. 4	T. G. T.	Do.
1838							
April 3	———	6. 7.30	6.30.19	7.34.41	6.50.37	T.	Do.
5	———	6.16. 4	6.53. 7	7.46.53	6.40.19	T.	Do.

Date.	Place of Observation.	δ Needle I.	δ Needle II.	δ Needle III.	δ Needle IV.	Observed by	Site—Remarks, &c.
		° ′ ″	° ′ ″	° ′ ″	° ′ ″		
1839							
Jan. 29	Madras		+* 6.55. 0			T. G T.	
Feb. 11	——	+**6.51.34	** 6.53.26			T. G. T.	
1838							
July 24	Sadras	+ 5.39.15		+ 5.30. 0		T. G. T.	In the traveller's bungalow.
Oct 14	——	5.30.18	+ 5.28. 7	5.22.30	+ 5.38. 7	T. G T.	
July 25	Thaumpaukum	+ 4.43.42		+ 5.12. 7		T. G. T.	Under the shade of a tree.
Oct. 13	Allumparva	+ 4.50.37	+ 4.48.23	+ 4.52.12	+ 5. 4.22	T. G. T.	Under a cadjan shed.
July 26	Pondicherry	+ 4.31.41	+ 4.25.56	+ 4.43.33	+ 4.25.56	T. G. T.	The master attendant's office.
27	——	4.21.34		4.12.19		T. G. T.	do.
28	——	4.31.15		4. 0.22		T. G. T.	do.
Oct. 12	——	4.20.57	4.25.18	4.27.11	+ 4.30 0	T. G. T.	The verandah of the post master's house.
July 31	Porto Novo	+ 3.24.22		+ 3. 0.23		T. G. T.	In Mr. Pugh's house.
Aug. 1	——	3.16.15		3. 3.52		T. G. T.	do.
Oct. 11	——	3. 8.26	3.11.52	3. 8.45	+ 3. 0.37	T. G. T	do.
Aug. 2	Sheally	+ 2.19.22		+ 2. 0. 0		T. G. T.	In the verandah of the traveller's bungalow.
Oct. 10	——	2.33. 7	+ 2.31.34	2.30. 0	+ 2. 6.15	T. G. T.	
1837.							
Aug. 3	Tranquebar	+ 2. 4.10		+ 1.58. 7		T. G. T.	In the guard room.
7	——	1.56.52		1.55.46		T. G. T. & J. C.	On top of the house.
8	——	2. 6.52		2.11.11		T. G. T. & J. C.	In the guard room.
9	——	2.13.22		2 8.45		T. G. T. & J. C.	do.
Oct. 9	——	2.11.15	+ 2.19. 8	2. 2,37	+ 1.48.26	T. G. T.	do.
Aug. 12	Negapatam	+ 2.32. 6		+ 1.22.54		T. G. T.	An open shed.
13	——	2 31.30		0.44.41		T. G. T. & J. C.	do.

* Observed with Captain D. Bethune's Instrument. ** Observed with Mr. Caldecott's new Instrument.

Date.	Place of Observation.	δ Needle I.	δ Needle II.	δ Needle III.	δ Needle IV.	Observed by	Site—Remarks, &c.
1837		° ′ ″	° ′ ″	° ′ ″	° ′ ″		
Oct. 2	Negapatam	+ 1.43,45	+ 1.23. 7	+ 0.21.33	+ 1.33.15	T. G. T.	Verandah of the hospital.
Aug. 13	Manargoody	+ 1, 4.41		+ 0.38. 5		T. G. T. & J. C.	Verandah of the missionary bungalow
14	Puttucottah	+ 0.52.37		+ 0.57.23		T. G. T. & J. C.	Verandah of the choultry.
15	Munamalegoody	+ 0. 7. 0		+ 0.15.17		T. G. T. & J. C.	do.
16	Kalehennary	+ 0. 4.15		+ 0 .8.30		T. G. T. & J. C.	do.
17	Ramuad	— 1.28,37		— 1.20.49		T. G. T. & J. C.	Verandah of the commanding officer's quarters.
Sept 30	Paumban	— 1.49. 3	— 1.24.22	— 1.34.43	— 1. 9.22	T. G. T.	Verandah of the Engineer's bungalow.
Aug. 20	Carryshandy	— 1.51.15		— 1.52.30		T. G. T. & J. C.	Verandah of the choultry.
21	Vadinatum	— 1.37.31		— 1.30.11		T. G. T. & J. C.	Open air near to the choultry—A hot land wind with much dust.
22	Powani	— 2.43.54		— 2.49.26		T. G. T. & J. C.	Mud hut belonging to the Missionaries. A hot and strong land wind—observation effected with difficulty.
Sept. 26	Tutocorin	— 2,27.30	— 2.45, 0	— 2.40.37	— 2.11.10	T. G. T.	In the verandah of Mr. Cory's house.
Aug. 23	Pallamcottah	— 1.50.26		— 2.48.45		T. G. T. & J. C.	In a cocoanut tope situated 20″ N. of the fort.
Sept. 22	———	2.48.26	— 2.48.45	2.40.19	— 2.46.34	T. G. T.	Verandah of a house in the middle of the fort.
Aug. 25	Nagracoil	— 3.54,26		— 3.51. 4		T. G. T. & J. C.	Verandah of the Missionary's house (Mr. Miller's).
Sept. 21	——=	4. 4.22	— 4 14.23	3.28.26	— 3.38.42	T. G. T.	do. do. (Mr. Malt's)

Date.	Place of Observation.	δ Needle I.	δ Needle II.	δ Needle III.	δ Needle IV.	Observed by	Site—Remarks, &c.
		° ′ ″	° ′ ″	° ′ ″	° ′ ″		
Aug. 28	Trivandrum	— 3,10,26		— 3.17.23		T. G. T. & J. C.	Meteorological bungalow.
Sept. 5	——	3. 4. 4	— 3 23.34	3.17.30		T. G. T. & J. C.	do.
13	——	3.10.56	3.17.49	3.24.26	— 2.35 37	T. G. T. & J. C.	do.
Nov. 20	——	2.41.53	2.58 7			J. C.	do.
20	——	3.13.11	3, 7.55			J. C.	do.
1838 Dec. 15	——	3.24. 4				J. C.	do.
1837 Nov. 15	Quilon	— 2.28. 8				J. C.	Residency grounds—in a mango tope, at about 100 yards to the south of the house.
1838 Dec. 15	——	* 2.15. 3					
1837 Nov. 12	Allepee.	2.12.49	— 2.30.19			J. C.	In a thatched shed in Mr. Anderson's compound, south of the house.
Nov. 12	——	1.59.41	1.57.12			J. C.	In a thatched shed in Mr. Anderson's compound, south of the house.
1[illegible]	——	0.57.49				J. C.	do. do.
1[illegible]	——	1. 1.15				J. C.	do. do.
1838 Dec. 20	——	* 2.37. 0				J. C.	do do.
1837 Nov. 8	Balghatty	+ 0.31.34	+ 0.17.30			J. C.	The Residency compound in a tent.
8	——	0.14. 4	0 41.53			J. C.	do. do.
8	——	0.18. 5	0. 5.37			J. C.	do. do.
8	——	——	0. 4.22			J. C.	do. do.
1838 Dec. 21	——	* 0.10. 6	* 0.21.18			J. C.	do. do.

* Observed with a new Dip apparatus by Mr. T. Jones.

Date.	Place of Observation.	δ Needle I.	δ Needle II.	δ Needle III.	δ Needle IV.	Observed by	Site—Remarks, &c.
		° ′ ″	° ′ ″	° ′ ″	° ′ ″		
1837 Nov. 6	Chetwaye	+ 1. 3.26	+ 1.17.30			J. C.	The N. E. room of the public bungalow (thatched).
	———	1.16.15	1. 3. 5 (?)			J. C.	
	———	1.17.30	1.17.30			J. C.	
" 5	Penaney	+ 1. 3. 8	+ 1.19.41			J. C.	The S. W. corner of the public bungalow (thatched).
" 4	Calicut	+ 1.38.15	1.51.53	+ 2.36.53	+ 2.12.30	J. C.	Under a tent pitched on the borders of the sea beach, among the cocoanut trees, 300 yards N. W. of the flag staff.
	———	1.13. 8	1.12.49			J. C.	

Consulting the above observations, with reference to the remarks at page 231 we may conclude as follows:—

Ongole.—The observations Nos. 1*. 2, 4, 5 and 7 appearing consistent, there is little fear of their not representing the true dip: No. 3 probably requires the second correction or + 0° 49' 0'': No. 6 the 1st correction, and No. 8 being doubtful, had better be omitted.
($\therefore \delta = -11° 36' 40''$)

Ramyapatam.—Here we have four results, Nos. 3, 5, 6 and 7, telling nearly the same tale, and in all probability the right one: in which case Nos. 1 and 2 require the minor correction—24' 30'' and Nos. 4 and 8 the second correction or—0° 49' 0''.
($\therefore \delta = +10° 14' 14''$)

Alloor.—Here Nos. 1, 2, 4, 5, 6 and 7 are coincident, exhibiting a deficiency to the amount of the 1st correction + 0°, 24' 30'' in Nos. 3 and 8.
($\therefore \delta = +10° 15' 46''$)

Nellore.—Nos. 2, 3, 4, 5, 6 and 8 are coincident: exhibiting an excess in Nos. 1 and 7 to the amount of the 2d correction or—0° 49' 0'': and No. 8 probably requires the first correction or + 0° 24' 30'', but being doubtful we will omit it.
($\therefore \delta = +9° 41' 16''$)

Woogelly.—Nos. 3, 4, 5, 6 and 7 are coincident, exhibiting a deficiency in No. 1, and an excess in No. 2 to the amount of the minor correction 0° 24' 30'': No. 8 being doubtful is omitted.
($\therefore \delta + 8° 49' 20''$)

Sooloorpet.—Nos. 1, 2, 4, 5, 6 and 7 are coincident, exhibiting a deficiency in Nos. 3 and 8 to the amount of the second correction or + 0° 49' 0'': but No. 8 had better be omitted.
($\therefore \delta = +8° 11' 17''$)

Poodaway.—These observations are the most discordant of any that have been made: they exhibit in Nos. 14 and 15 nearly the two extreme cases which *can* happen: on looking over the several values, from the coincidence found in Nos. 1, 2, 3, 4, 6, 9 and 10, we naturally conclude that they re-

* These numbers refer to the order in which the values stand in the table.

present the true dip: in which case, Nos. 5 and 12 require the third correction; Nos. 7 and 8 the 1st; and Nos. 11 the 4th or largest correction.
($\therefore \delta = +7° 16' 46''$)

Madras.—Nos. 1, 2, 3, 4, 5, 6, 7, 8, 12, 14, 16, 17, 18 and 19 probably exhibit the true values of the dip—in which case Nos. 9, 11 and 15 require the second correction, and Nos. 10 and 13 require the first or minor correction only.
($\therefore \delta = +6° 50' 4''$)

Sadras.—The general mean will probably be pretty near the truth.
($\therefore \delta = +5° 31' 23''$)

Thaumpaukum.—Nos. 1 or 2 require the minor correction to produce an agreement *inter se*, but since in either case we might possibly be in error, it will be as well to take the mean, and mark the result as *doubtful.*
($\therefore \delta = +4° 57' 54''$) *doubtful.*

Allumparva.—Was visited on my return homeward, instead of Thaumpaukum, in consequence of its affording better shelter than the latter place: the observations all agree pretty well, although No. 4 probably requires the minor correction.
($\therefore \delta = +4° 50' 16''$)

Pondicherry.—The first and third observations with needle No. 3 apparently require the minor correction.
($\therefore \delta = +4° 27' 12''$)

Porto Novo.—The first observations apparently requires the minor correction.
($\therefore \delta = +3° 6' 15''$)

Sheally.—The observations with Nos. 2 and 6 seem to require the minor correction.
($\therefore \delta = +2° 28' 13''$)

Tranquebar.—No. 12, which we may as well omit, seems to require the minor correction.
($\therefore \delta = +2° 5' 17''$)

(*Negapatam.*—It is quite impossible at first sight to form any idea of the true dip from these observations. On consulting those made on 2d October, we may

adopt with equal propriety, the mean of Nos. 1 and 4 (1° 38′ 30″), or of Nos. 2 and 3 (1° 22′ 20) as the true dip. On consulting the previous observations, we find that they may be brought to agree with the first of these values, by allowing the second correction in Nos. 1, 3 and 4, and the first correction in No. 2; whereas to reconcile them with the second value found above, we must admit the *third* correction in Nos. 1 and 3: and the second in No. 4. Hitherto the minor correction only having been found sufficient to reconcile the observations made by myself, I think it little likely that *the third correction should apply twice* at the same station, particularly as the observations on the second day were made with more than ordinary care on account of the disagreement met with on the first day of observation: or, it would appear on the whole that the most probable value for the true dip will be found, by allowing the first correction in Nos. 2, 6 and 7; and the second correction in Nos. 1, 3 (∴ $\delta = +\ 1°\ 42'\ 10''$) and 4.

Manargoody.—One or the other of these observations probably represents the true dip, in which case the other observations requires the minor correction.
(∴ $\delta = +\ 0°\ 39'\ 8''$ or $+\ 1\ \ 3\ \ 38$)

Puttoocottah.—The mean of these is probably pretty near the truth.
(∴ $\delta = +\ 0°\ 55'\ 0''$)

Munamalegoody.—The mean of these is probably pretty near the truth.
(∴ $\delta = +\ 0°\ 10\ \ 34''$)

Kalehenary.— Do. do. ∴ $\delta = +\ 0°\ \ 6'\ 22''$.

Ramnad.— Do. do. ∴ $\delta = -\ 1°\ 24'\ 42''$.

Paumban.—No. 4 appears to require the minor correction.
(∴ $\delta = -\ 1°\ 35'\ 30''$)

Carryshandy.—Observations coincident— $\therefore \delta = -1^\circ\ 51'\ 52''$.

Vadinatum.— Do. do. $\therefore \delta = -1\ \ 33\ \ 51$.

Powani.— Do. do. $\therefore \delta = -2\ \ 46\ \ 10$.

Tutocorin.—No. 4 appears to require the minor correction, but the ($\therefore \delta = -2^\circ\ 37'\ 42''$) amount being doubtful it had better be omitted.

Palamcottah.—The large quantity of dust floating in the air, and the hot land wind, rendered observing irksome and difficult on the 24th August, which may account for the magnetising of the needles having been less successfully accomplished than heretofore:—it would appear that No. 1 requires the second correction, and No. 2 the third; but they had ($\therefore \delta = -2^\circ\ 46'\ 1''$) better all three be omitted.

Nagracoil.—Nos. 4 and 5 appear each to require the minor correction. ($\therefore \delta = -3^\circ\ 53'\ 3''$)

Trivandrum.—The observation with needle No. 4 had better be omitted; Nos. 10 and 11 apparently require the minor ($\therefore \delta = -3^\circ\ 15'\ 24''$) correction.

Quilon.—The observations are coincident. $\therefore \delta = -2^\circ\ 21'\ 35''$.

Allepee.—These observations are so singularly discordant, that no sort of ($\therefore \delta = -x$) estimate can be made of the value of δ.

Balghatty.—No. 4 apparently requires the minor correction. ($\therefore \delta = +0^\circ\ 18'\ 46''$)

$\circ\ \ '\ \ ''$

Chetwaye.—Observation coincident— $\therefore \delta + 1\ \ 12\ \ 34$.

Penaney.— do. do.— $\therefore \delta + 1\ \ 11\ \ 25$.

Calicut.—Observation coincident— $\therefore \delta + 2\ 42\ 43$

Tellicherry.—The observations made at this place are so singularly discordant, that they had better stand over for the present.

The above values of the dip, when laid down upon a map, exhibit an appearance something resembling a series of parallels of latitude,—save that the errors of observation (which somewhat disturb their uniformity), prevent our discovering if these lines *be* parallel to the equator, or if their inclination tends towards it on the eastern, or on the western side of the Peninsula. To arrive at a more correct knowledge of this matter, we will in the first place suppose them to be parallel, and proceed to find the latitudes of the magnetic equator, corresponding to the several longitudes, from the well known formula

$$\tan \delta = 2 \tan \lambda$$

where δ represents the dip and λ magnetic the latitude of the place. It may be objected—that this formula obtains only on the old hypothesis, of there being two magnetic poles symmetrically situated in a diameter of the earth, and near to its centre,—an hypothesis which is not completely borne out by our present improved knowledge:—however valid this objection may be with reference to high latitudes; a slight consideration of the subject, renders it clear, that in the case of *our* observations (which twice cross the magnetic equator), a result very nearly approaching to the truth will be obtained by this formula: accordingly we get as follows—

Geographical situation of various places on the Coast of India, with the observed Dip, and corresponding deduced Latitude of the Magnetic Equator.

	Long.	Latitude	Obsd. Dip. $\delta_{,}$	Latitude of Mag. Eq.	Remarks.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	
Ongole........	80 5 E	15 30 N	+11 36 40	+9 38 3	
Ramapatam.....	80 6	15 3	10 44 14	9 38 40	
Alloor........	80 7	14 41	10 18 46	9 29 5	
Nellore.......	79 2	14 28	9 41 16	9 35 17	
Woogelly......	89 58	14 1	8 49 20	9 35 28	
Sooloorpet....	80 3	13 41	8 11 17	9 34 5	
Poodway.......	80 11	13 21	7 16 46	9 42 14	
Madras........	80 17 12	13 4.9	6 50 4	9 38 23	
Sadras........	80 12	12 32	5 31 23	9 45 55	
Thaumpaukum...	80 2	12 12	4 57 54	9 46 46	Doubtful.
Allumparva....	80 2	12 14	4 50 16	9 48 36	
Pondicherry...	79 54	11 54	4 27 12	9 40 12	
Porto Novo....	79 48	11 29	3 6 15	9 55 48	
Sheally.......	79 50	11 16	2 28 13	10 1 51	
Tranquebar....	79 55	11 1	2 5 17	9 58 21	
Negapatam.....	79 51	10 46	1 42 10	9 51 54	Doubtful.
Manargoody....	79 32	10 40	0 39 8	10 20 26	The latter of these is no doubt correct.
——	——	——	1 3 38	10 8 10	
Puttoocottah....	79 23	10 27	0 55 0	9 59 30	
Munamelegoody	79 15	10 3	0 10 34	9 57 43	
Kalehernary....	79 0	9 40	+ 0 6 22	9 36 49	It would appear that this value of δ, requires the 2d correction or $\delta_{,}$ = − 0° 42″ 38′.
Ramnad........	78 54	9 22	− 1 24 42	10 4 23	
Paumban.......	79 5	9 7	1 35 30	10 4 46	
Carryshandy....	78 27	9 11	1 51 32	10 6 57	
Vadinatrum.....	78 10	8 57	1 33 51	9 43 56	This value of δ probably requires the second correction, or δ = − 2°22′51″.
Powani.........	77 57	8 49	2 46 10	10 1 28	
Tutocorin......	78 14	8 48	2 37 42	10 6 54	
Palamcottah....	77 48	8 41	2 46 1	10 7 3	
Nagracoil......	77 28	8 11	3 53 3	10 7 40	
Trivandrum.....	76 59	8 30 35	3 15 24	10 8 22	
Quilon.........	76 56	8 51 0	2 21 35	10 4 49	
Allepee........	76 21	9 31 0	x		
Balghatty......	76 17	9 58 30	+ 0 18 46	9 49 7	
Chetwaye.......	76 4	10 32 6	1 12 34	9 55 48	
Penaney........	75 55	10 46 30	1 11 25	10 10 46	
Calicut........	75 49	11 15 25	2 42 43	9 53 51	
Tellicherry....		11 45 0			

Neglecting the observation at *Thaumpaukum*, and adopting the second value for *Manargoody*, we get as follows :—

	Latitude.	Longitude.	Lat. of M. Equator.
	° ′	° ′ ″	° ′ ″
From 9 Stations in	12 32 N 15 30 N	80 6 47	+ 9 37 28
—— 13 ———	2 14 N 9 11 N	79 27 23	9 56 46
—— 11 ———	8 57 N 8 11 N 11 15 N	77 3 38	10 1 51

On comparing each of these with its several constituent values, we find that the mean error at a single station is 6′, 33″; from which we should conclude, that the latitude of the magnetic equator, derived from the first 9 stations, as far as error of observation goes, is probably not above 2 or 3 minutes in error: and the same may be said of the result from 13, and of that from 11 observations. Hence we are free to infer that the discordance which exists between these three values, as compared with the longitude, is without the limit of error of observations; and since no simple value of inclination of the isoclinal lines would reconcile both the longitudes and latitudes, we are left to conclude, either that the isoclinal lines (arising from local causes) are undulating, or that we have assumed an erroneous theory.

Having come to this conclusion, we will now proceed with the observations at these three groups of stations, to obtain values for the inclination of the isoclinal lines to the meridian (θ); and the rate of variation (r) corresponding to a variation (of one minute for instance) in the latitude. For this purpose, let λ and μ represent respectively the longitude and latitude of any principal station (O) to which we wish to refer a group of observations; and $\lambda_,$ and $\mu_,$ the same for any one of the other stations. Let P represent the pole of the earth: P O the meridian of the said principal station, and P Q the meridian of any one of the stations which we wish to refer to O. From Q let fall Q R perpendicular to P O; or, since R O and R Q will in no case exceed $1\frac{1}{2}$ or 2 degrees, we may, for simplicity sake, make R O a parallel of latitude; when

$$R\,O = A = \lambda - \lambda_,$$

$$\text{and } R\,Q = B = (\mu - \mu_,) \cos \lambda_,$$

Let O S represent an isoclined line, making the single O S P $=\theta$ with the meridian, and draw Q T $= p$ perpendicular to it; then we get

$$p = (B.\cos\theta + A.\sin\theta) \text{ nearly.}$$

Now, within the limited range of each group of stations, we may safely allow, that the dip varies as the distance—that r remains constant;—hence

$$\delta - \delta_, = r\,p$$

or $\delta - \delta_, = r\cos\theta.\,B + r\sin\theta.\,A$; where, substituting x, and y, for the terms $r.\sin\theta$ & $r.\cos\theta$, and restoring the values of A & B,

$$\delta - \delta_, = (\mu - \mu_,)\cos\lambda_,.\ x + (\lambda - \lambda_,)\, y.$$

The stations proper to be chosen for principal stations, are evidently those which are situated in the middle of the group, or such as we have already obtained; where

λ	μ	δ
° ′ ″	° ′ ″	° ′ ″
+ 14 2 20	80 6 47	+ 8 46 49
10 33 51	79 27 23	+ 4 11 4
9 24 11	77 3 33	— 1 15 18

whence we deduce the following, for the first group,

Place of observation.	$\lambda_{,}$	$\mu_{,}$	A or $(\lambda-\lambda_{,})$	B or $(\mu - \mu_{,})$ cos. $\lambda_{,}$	D or $(\delta-\delta_{,})$	w
	° ′	° ′			′	
Ongole	+15 30	+80 5	— 88	+ 2	— 169,9	4
Ramapatam	15 3	80 6	61	1	117,4	4
Alloor	14 41	80 7	39	0	92,0	4
Nellore	14 28	80 2	26	5	54,5	4
Woogelly ..	14 1	79 50	+ 1	9	2,5	4
Sooloorpet ...	13 41	80 3	21	4	+ 35,5	4
Podway	13 21	80 11	41	— 4	90,0	6
Madras	13 5	80 17	57	10	116.7	9
Sadras	12 32	80 12	90	5	195,4	3

Similarly we get for the second group.

Place of observation.	$\lambda_{,}$	$\mu_{,}$	A or $\lambda - \lambda_{,}$	B or $(\mu-\mu_{,})$ cos. $\lambda_{,}$	D or $(\delta-\delta_{,})$	w
	° ′	° ′			′	
Allumparva	+12 14	+80 2	— 100	— 34	—216 2	3
Pondicherry	11 51	79 54	80	26	193 1	7
Porto Novo......	11 29	79 48	55	20	112 1	4
Sheally	11 16	79 50	42	22	74 1	3
Tranquebar	11 1	79 55	27	27	51 2	6
Negapatam	10 46	79 51	12	23	28 1	3
Manargoody	10 40	79 32	6	5	+ 10 5	2
Puttoocottah	10 27	79 23	+ 7	+ 4	19 1	2
Munamelogoody...	10 3	79 15	31	12	63 5	2
Kalehennary	9 49	79 0	54	26	67 7	2
Ramnad	9 22	78 54	72	32	158 8	2
Paumban	9 17	79 5	77	22	169 6	3
Carryshandy	9 11	78 27	83	59	186 0	2

And further, for the third group.

Place of observation.	$\lambda_,$	$\mu_,$	A or $\lambda - \lambda_,$	B or $(\mu - \mu_,)\cos.\lambda_,$	$(\delta - \delta)$	w
	° ′	° ′			′	
Vadinatrum.........	+ 8 57	78 10	+ 27	− 66	+ 18 2	2
Powani	8 49	77 57	35	52	90 9	2
Tutocorin	8 48	78 14	36	69	82 4	4
Palamcottah	8 44	77 48	40	43	90 7	4
Nagracoil	8 11	77 28	73	24	157 8	4
Trivandrum . ..	8 30	76 59	54	+ 5	120 1	7
Quilon........	8 54	76 56	80	8	66 3	2
Allepe......... ...	9 31	76 21	− 7	42	....	....
Balghatty	9 58	76 17	34	46	− 94 1	6
Chetwaye	10 32	76 4	68	59	117 9	4
Penaney	10 46	75 58	82	65	146 7	2
Calicut	11 15	75 49	111	74	238 0	5

We have found above, that

$$\delta - \delta_, = \mathrm{A}\,x + \mathrm{B}\,y\ ;\text{—put} = \mathrm{D}$$

and it only remains, that, with the above values of A, B, $(\delta - \delta_,) = \mathrm{D}$ and the weight *(w)* (determined from a consideration of the number and goodness of the observations constituting each result); we should now, by the method of minimum squares, determine the most probable values for x & y: to accomplish this, we must, after multiplying the above equation by w, again multiply it successively by the coefficients of the quantities sought; when we get equations of the form

$$\mathrm{A}^2\,w\,x + \mathrm{A\,B}\,w\,y = \mathrm{A\,D}\,w$$

and $$\mathrm{A\,B}\,w\,x + \mathrm{B}^2\,w\,y = \mathrm{B\,D}\,w$$

from which, by the following equations of conditions, the most probable values of x and y will now be obtained:

$30976\,x - 704\,y = \pm\ 59804{,}8$	$-\ 704\,x + 16\,y = -\ 1359{,}2$
$14884 - 244 = +\ 28645{,}6$	$-\ 244 + 4 = -\ 469{,}6$
$6084 - 0 = +\ 14352{,}0$	$-\ 0 + 0 = 0{,}0$
$2704 - 520 = +\ 5668{,}0$	$-\ 520 + 100 = -\ 1090{,}0$
$4 + 36 = -\ 10{,}0$	$+\ 36 + 324 = +\ 90{,}0$
$1764 + 336 = +\ 2982{,}0$	$+\ 336 + 64 = +\ 568{,}0$
$10086 - 984 = +\ 22140{,}0$	$-\ 984 + 96 = -\ 2160{,}0$
$29241 - 5130 = +\ 59867{,}1$	$-\ 5130 + 900 = -\ 10503{,}0$
$24300 - 1350 = +\ 52758{,}0$	$-\ 1350 + 75 = -\ 2344{,}8$

taking the sum we get

$$120043\,x - 8560\,y = 246207{,}5 \qquad - 8560\,x + 1579\,y = -17268{,}6$$

and for the second series

$+ 30000\,x$	$+ 10200\,y$	$= + 64860{,}0$	$+ 10200\,x$	$+ 3468\,y$	$= 22052{,}4$
44800	+ 14560	= + 108136,0	14560	+ 4732	= + 35144,2
12100	+ 4400	= + 24662,0	4400	+ 1600	= + 8968,0
5292	+ 2772	= + 9336,6	2772	+ 1452	= + 4890,6
4374	+ 4374	= + 8294,4	4374	+ 4374	= + 8294,4
432	+ 828	= + 1011,6	828	+ 1587	= + 1938,9
72	+ 60	= − 126,0	60	+ 50	= − 105,0
98	+ 56	= + 267,4	56	+ 32	= + 152,8
1922	+ 744	= + 3937,0	744	+ 288	= + 1524,0
5832	+ 2808	= + 7311,6	2808	+ 1352	= + 3520,4
10368	+ 4608	= + 22867,2	4608	+ 2048	= + 10163,2
17787	+ 5082	= + 39177,6	5082	+ 1452	= + 11193,6
13778	+ 9794	= + 30876,0	9794	+ 6962	= + 21948,0

taking the sum we get

$$146855\,x + 60286\,y = 320611{,}4 \qquad 60286\,x + 29397\,y = 129685{,}5$$

and for the third series

$1458\,x$	$- 3564\,y$	$= + 982{,}8$	$- 3564\,x$	$+ 8712\,y$	$= - 2402{,}4$
2450	− 3640	= + 6363,0	− 3640	+ 5408	= − 9453,6
5184	− 9936	= + 11865,6	− 9936	+ 19044	= − 22742,4
6400	− 6880	= + 14512,0	− 6880	+ 7396	= − 15600,4
21316	− 7008	= + 46077,6	− 7008	+ 2304	= − 15148,8
20412	+ 1890	= + 45397,8	+ 1890	+ 175	= + 4203,5
1800	+ 480	= + 3978,0	+ 480	+ 128	= + 1060,8
6936	− 9384	= + 19196,4	− 9384	+ 12696	= − 25971,6
18496	− 16048	= + 40228,8	− 16048	+ 13924	= − 34904,4
13448	− 10660	= + 24058,8	− 10660	+ 8450	= − 19071,0
61605	− 41070	= + 132090,0	− 41070	+ 27380	= − 88060,0

taking the sum we get

$$159505\,x - 105820\,y = 344750{,}8 \qquad - 105820\,x + 105617\,y = - 228090{,}3$$

Resolving these three pairs of equations, we get

x	y
+ 2,07218	+ 0,29708
2,35365	− 0,41532
2,17310	+ 0,01770

and since $x = r \sin. \theta$ and $y = r \cos. \theta$; we get

$$\frac{x}{y} = \tan. \theta \qquad \text{or in numbers.}$$

θ	r	
° ′	′	
+ 81 50	2,0934	for one geographical mile.
100 1	2,3900	—— —— ——
89 32	2,1731	—— —— ——

Shewing that a flexure takes place in the direction of the isoclinal lines, as represented in fig. 3—much at variance with the supposed uniformity of their curvature,—and with reference to r, a determined variation from the theory ($\tan. \delta = 2 \tan. \lambda$) in which r cannot exceed 2:—If we now refer to page 213 for the mean values of δ and λ; we can, from the above values of r and θ, compute more correct values than we have yet obtained of the latitude of the magnetic equator; thus

μ	Lat. of Mag. Equator.
° ′ ″	° ′ ″
80 6 47	+ 9 53 4
79 27 23	10 3 35
77 3 38	9 58 53

These values are no doubt very near the truth; the only doubt which can exist, is, whether we ought not to have rejected the observations at Kalehannary and Vadinatrum? If we had done so, the above 2d and 3d values would each be increased about two minutes.

Intensity Observations.

I have already mentioned that the intensity needles, employed for a great portion of this work, were constructed by myself, immediately before quitting Madras,—when I had observed with them for about 30 or 40 days only. During this time, no perceptible alteration in the magnetic intensity* of either of them having taken place, I determined to trust to their invariability†—or rather to give the results, if on my return to Madras it appeared that the needles had not varied;—and the needles constructed by Mr. Caldecott, had not been in use for a day previously to my quitting Trivandrum. Under these circumstances, it will naturally be expected that our intensity observations are of little worth; particularly since the observations have been made over a tract of country, where from theory we know that an almost invariable intensity must prevail;

* The needles of this construction employed in England for measuring magnetic intensity, have generally been found to part with their intensity, during the first two years after being magnetized.

† The two needles to which this remark belongs, remained suspended in their boxes during this time: had they been handled even, experience since shews that a difference would probably have been obtained.

and that, to trace the law of its variation under these circumstances, observations of far more than ordinary accuracy should be employed. I had however other motives in view in making these observations than that of discovering from them the *law* of magnetic intensity. My object was, *not* to discover the law, but—assuming the law according to theory—how far it was transgressed by incidental or local causes: for, with regard to the latter, our track along the Coromandel coast, surrounded by extensive sandy plains, would form a fair field for exhibiting the effect of local disturbances, when contrasted with the vast granitic formations and elevations to be met with in and near to Travancore and along the Western coast generally.

With thus much by way of explanation, I will now lay before the reader the whole of the observations, even those which I shall eventually propose to reject, in order, that no more, or less importance may be attached to them, than they are fairly entitled to. I will here mention one trifling circumstance with regard to Mr. Caldecott's needles; namely, that, with a view to try if their intensities might not be rendered at once invariable, before leaving Trivandrum I submitted each of them to rather rough usage by hard friction. The effect of this was, that a diminution of intensity ensued at once—to the amount of about 20 seconds in performing 100 vibrations. How far this might be carried, is a matter of interest for which I may not pause here, save to remark, that, as far as my experience goes, a needle may by this means at once be brought to a fixed intensity; of which more presently. It only remains for me to add, that the same observers and the same stations as those mentioned in the dip observations, apply to these.

Corrections to be applied to the Intensity Observations.

The corrections to be applied to the observed time of one of these needles, performing 100 vibrations, are three in number.

1st.—On account of R the rate of the chronometer; which renders necessary the correction

$$\text{rate} = \text{I} - \left(\text{I} \times \frac{86400}{86400 + \text{R}}\right)$$

2d.—*On account of arc.* To reduce the time of vibration performed in a circular arc commencing from A°, and terminating at a°, to that which would have been noted had the vibrations been performed in an infinitely small circular, or a cycloidal arc, the correction is

$$\text{corr. for } arc = + \text{ I} \times \frac{\sin.\ (\text{A} + a).\ \sin.\ (\text{A} - a)}{32\ \text{M}\ (\log.\ \sin.\ \text{A} - \log.\ \sin.\ a)}$$

where M = the logarithmic modulus = 2,302585; and A and a, throughout—have always been 20° and $6\frac{1}{2}$° respectively; or correction for arc = + (I ×,0022).

3d.—*On account of temperature.*—It being found that a magnetized needle exhibits a greater degree of intensity in cold than in warm weather, it is necessary to render the observations comparable—that they should either all be made at the same temperature, or that, if the temperature vary, a correction proportionate thereto should be employed: for this purpose I have lately made several observations with the three needles employed by myself, at temperatures between 70° and 80°; by observing in a cool room of uniform temperature, and afterwards in one with a low roof with a higher temperature, when the following rates of alteration were observed :

No. observations.	Needle No. 1 Faht. therm.	Needle No. 1 Time of 100 vib.	Needle No. 2 Faht. therm.	Needle No. 2 Time of 100 vib.	Needle No. 3 Faht. therm.	Needle No. 3 Time of 100 vib.
	°	s	°	s	°	s
from 3	$t' + 8,0$	$I_, + 0,37$	$t' + 14\ 5$	$I_, + 0,90$	$t' + 8.0$	$I_{,,,} + 0\ 65$
——	$t' + 11,0$	$I_, +\ ,70$	$t' + 10\ 8$	$I_{,,} + 0.60$	$t' + 8.8$	$I_{,,,} + 0,27$
——	$t' + 11,4$	$I_, +\ ,57$	$t' + 12.3$	$I_{,,} + 0,70$	$t + 9.1$	$I_{,,,} + 0,44$

where I, $I_{,,}$ $I_{,,,}$ represent the time of performing 100 vibrations at the lower temperature (t')—If I represent the time of performing 100 vibrations at the standard temperature t; and $I_,$ that of performing the same at any other temperature t' then the correction

$$I - I = a\,I\,(t - t')$$

$$\text{or} \quad a = \frac{I - I_,}{I\,(t - t')}$$

In which I, $I_{,,}$ $I_{,,,}$ were $\overset{s}{282}$, $\overset{s}{312}$, and $\overset{s}{277}$ respectively; whence

$a =$,00018 for needle No. 1.

$=$,00019 —— No. 2.

$=$,00019 —— No. 3.

This near and unusual agreement *inter se*, arising no doubt from my not having employed artificial heat (as has been usual in observations of this nature), has induced me to suppose that the remaining two needles require the same correction, which consequently has been applied in the reductions (Table III). This premised, we may now proceed to the

Discussion of the Intensity Observations.

In the examination of the intensity observations, it will be found convenient and necessary, to divide them into three several classes, and to discuss the observations with each needle—cylinder rather—in each class separately; thus—

Class 1st.—*Observations made from Madras to Trivandrum and back again.*

— 2d.—*Observations made from Tellicherry to Trivandrum.*

— 3d.—*Observations made from Madras to Ongole and back again.*

Class I.

If we now attentively examine Table II, in which this arrangement has been made for the first class of the cylinder T. G. T. No. 1, we perceive that the numbers in the column "difference," decrease pretty uniformly, in something like a geometrical progression, corresponding to an arithmetical advance of the time,—until at *Nagracoil*, we find that for nearly a month, no alteration had taken place in its intensity. If we examine the observations with cylinder T. G. T. No. 2, we find that precisely the same circumstance occurs; and on examining T. G. T. No. 3, it appears, that—with the exception of a difference of 10,00 seconds caused by the cylinder having been let fall,—during nine weeks its intensity remained unchanged. If then it be admitted for cylinders Nos. 1 and 2, that they had arrived at a fixed state of intensity on the 25th August; and that No. 3 had done so on the 2d August, it only remains, that we should cancel the observations made previously to these dates, and adopt those made subsequent thereto. One circumstance, however, must be noticed with regard to cylinders Nos. 1 and 2, namely—that the observations at eight stations made in the course of our *onward* march, (between Negapatam and Palamcottah), have purposely been omitted; the cylinders when at these places not having arrived at a fixed state of intensity, the observations must necessarily be given up. With regard to the two cylinders constructed by Mr. Caldecott, I have already mentioned that I had submitted them to rather rough usage; by which their intensities had at once been reduced to the amount of several seconds for performing 100 vibrations; my intention was to bring them at once to a fixed state of intensity, for I can state with considerable confidence, that *when a needle is magnetized to saturation, its loss of magnetic intensity is due alone to the necessary violence employed in its use.* I have employed a cylinder which was magnetized to saturation for a month—not touching it—without its having parted with any portion of its magnetism; but on applying the armature, and then again vibrating it, a change of several seconds has immediately resulted. In confirmation of these views, it will be noticed that on the return of cylinders J. C. 1 and 2 to Trivandrum, after an absence of ten weeks, in which they had travelled over 1200 miles,

No. 1 had varied its intensity	+ $\overset{s}{0.40}$	in performing
2 —— —— ——	− 0.87	100 vibrations.

TABLE II.

CLASS Ist—Cylinder T. G. T. No. 1.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermo-meter.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80° Temperature	Differ-ence.
1837			s	m s	°	s	s	s	s	s
July	18	Madras	259,46	+ 0 8,0	85,6	—,572	— ,024	— ,275	259,14	— 14,84
October	16	,,	274,23	— 0 21,5	85,5	,604	+ ,070	,286	273,98	
July	24	Sadras.	262,80	— 0 11,0	87,4	,579	+ ,033	,368	262,62	9,98
October	14	,,	272,87	— 0 21,5	85,0	,601	+ ,068	,259	272,60	
October	13	Allumparva	274,53	— 0 21,5	89,0	,694	+ ,068	,468	274,46	
July	27	Pondicherry	266,56	— 0 11,0	87,7	,587	+ ,032	,388	266,39	7,65
October	12	,,	274,13	— 0 21,5	88,5	,604	+ ,068	,443	274,04	
July	31	Porto Novo	268,30	— 0 12,0	89,5	,591	+ ,039	,484	268,23	5,52
October	11	,,	273,80	— 0 21,5	89,4	,604	+ ,068	,486	273,75	
August	2	Sheally	269,53	— 0 12,0	86,0	,593	+ ,039	,306	269,58	5,12
October	10	,,	274,87	— 0 21,5	83,2	,605	+ ,068	,166	274,50	
August	7	Tranquebar	270,97	+ 3 49,0	92,8	,596	— ,689	,656	270,36	
	10	,,	270,20	— 0 12,0	87,6	,595	+ ,039	,389	270,03	4,00
October	7	,,	274,20	— 0 21,5	91,5	,604	+ ,068	,540	274,20	
August	11	Negapatam	270,70	+ 3 49,0	92,4	,596	— ,715	,632	270,02	3,45
October	3	,,	273,97	— 0 21,5	80,2	,603	+ ,068	,010	273,47	

CLASS 1st.—Cylinder T. G. T. No. 1 *continued.*

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for			Time of 100 vibrs. at 80° Temperature	Difference.
						Arc.	Rate.	Temp.		
1837			s	s m	°	s	s	s	s	s
August	24	Pallamcottah....	267,50	+ 3 49,0	95,5	—,589	— ,709	+,775	266,98 }	* 8,55 or 3,20 per- [haps.
September	22	"	275,67	— 0 21,5	87,6	,607	+ ,068	,400	275,53 }	
August	25	Nagracoil........	275,10	+ 3 48,0	86,7	,606	— ,724	,353	274,12 }	0,29
September	21	"	274,63	— 0 21,5	86,2	,605	+ ,064	,321	274,41 }	
August	28	Trivandrum	275,57	+ 3 46,5	84,7	,607	— ,709	,245	274,50 }	— 0,51
September	16	"	274,20	— 0 20,5	86,4	,604	+ ,064	,332	273,99 }	
September	26	Teutocorin	274,77	— 0 20,0	85,8	,605	+ ,068	,303	274,54	
September	30	Paumban...........	274,47	— 0 20,0	87,6	,605	+ ,068	,395	274,33	

* The observation on the 24th August is from the mean of two sets; thus—
In the outer verandah: time of 100 vibrations 267,60*s*:—removed to a distance of 30 or 40 yards into a cocoanut tope the time of 100 vibrs. = 267*s*,41.
Notwithstanding this agreement, I think we must have counted 98 vibrations only instead of 100, which is a mistake very easily committed.
The other observation (that on 22d September), was made under the verandah of a house in the Fort, near to the commanding officer's quarters, and three-fourths of a mile from the above.

CLASS Ist—Cylinder T. G. T. No. 2.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80° Temperature	Difference.
1837			s	m s	°	s	s	s	s	s
July	18	Madras	271,42	+ 0 8,0	85,5	—,599	— ,035	+ ,281	271,14	20,27
October	16	,,	291,70	— 0 21,5	85,0	,641	+ ,072	,277	291,41	
July	24	Sadras	273,53	— 0 11,0	87,5	,603	+ ,035	,392	273,35	17,30
October	14	,,	291,00	— 0 21,5	84,0	,641	+ ,072	,221	290,65	
do	13	Allumparva	292,03	— 0 21,5	88,8	,644	+ ,072	,484	291,94	
July	27	Pondicherry	282,26	— 0 11,0	87,4	,623	+ ,036	,396	282,07	9,66
October	12	,,	291,83	— 0 21,5	88,6	,644	+ ,072	,475	291,73	
July	31	Porto Novo	281,50	— 0 12,0	88,6	,621	+ ,039	,460	281,38	10,35
October	11	,,	291,66	— 0 21,5	90,6	,642	+ ,072	,586	291,68	
August	2	Sheally	285,65	— 0 12,0	86,4	,629	+ ,039	,347	285,41	6,33
October	10	,,	292,10	— 0 21,5	83,8	,644	+ ,072	,211	291,74	
August	7	Tranquebar	284,93	+ 3 49,0	92,4	,628	— ,758	,667	284,13	
,,	10	,,	284,53	— 0 12,0	87,3	,627	+ ,039	,394	284,34	8,23
October	7	,,	292,87	— 0 21,5	91,2	,644	+ ,072	,160	292,46	
August	11	Negapatam	285,33	+ 3 49,0	92,5	,629	— ,759	,672	284,61	6,97
October	3	,,	292,13	— 0 21,5	80,4	,643	+ ,072	,022	291,58	

CLASS Ist.—Cylinder T. G. T. No. 2 *continued.*

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80° Temperature	Difference.
1837			s	m s	°	s	s	s	s	s
August	24	Pallamcottah....	*286,73	+ 3 49,0	90,7	—.633	— ,760	+,576	285,91	
September	22	”	295,03	— 0 21,5	87,6	,65	+ ,073	,423	294,87	8,96
August	25	Nagracoil.......	293 60	+ 3 48.0	86,7	,647	— ,774	,372	292.55	
September	21	”	293,57	— 0 20,5	86,4	,646	+ ,070	,356	293,35	0,80
August	28	Trivandrum	295.47	+ 3 46,5	84,7	,651	— ,774	,264	294,31	
September	16	”	293,80	— 0 20,5	86,3	,647	+ ,070	,351	293,57	—0,74
September	26	Teutocorin	293,97	— 0 20,0	85,6	,646	+ ,068	,312	293,70	
September	30	Paumban.......	292,07	— 0 20,0	85,8	,643	+ ,067	,322	291,82	

* After making this observatiou I let the needle fall from my hand to the ground.

CLASS 1ST.—Cylinder T. G. T. No. 3.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837			s	m s	"	s	•	s	s	s
July	18	Madras........	245,82	+ 0 8,0	86,0	−,542	− ,022	+ ,281	245,54 }	20,54
October	16	,, ...	266,30	− 0 21,5	86,0	,582	+ ,066	,301	266,08 }	
July	24	Sadras	247,80	− 0 11,0	86,3	,546	+ ,032	,297	247,58 }	18,02
October	14	,, ...	265,83	− 0 21,5	85,7	,583	+ ,066	,284	265,60 }	
October	13	Allumparva	266,67	− 0 21,5	83,7	,584	+ ,066	,445	266,60	
July	27	Pondicherry	250,49	− 0 11,0	87,8	,551	+ ,032	,370	250,34 }	15,87
October	12	,, ...	266,27	− 0 21,5	89,0	,584	+ ,066	,455	266,21 }	
July	31	Porto Novo	253,75	− 0 12,0	88,8	,557	+ ,035	,424	253,65 }	13,78
October	11	,, ...	267,27	− 0 21,5	93,0	,564	+ ,067	,656	267,43 }	
August	2	Sheally....	256,80	− 0 12,0	87,3	,563	+ ,036	,356	256,63 }	9,78
October	10	,, ...	266,70	− 0 21,5	84,4	,583	+ ,067	,221	266,41 }	
August	7	Tranquebar....	257,00	+ 3 49,0	91,7	,560	− ,678	,566	256,43 }	11,80
,,	10	,, ...	255,53	− 0 12,0	87,1	,559	+ ,036	,345	255,35 }	
October	7	,, ...	267,60	− 0 21,5	92,0	,585	+ ,067	,611	267,69 }	
August	11	Negapatam....	257,77	+ 3 49,0	93,0	,563	− ,684	,637	257,16 }	11,35
October	3	,, ...	269,03	− 0 21,5	80,0	,584	+ ,066	,000	268,51 }	

Class 1st.—Cylinder T. G. T. No. 3.

Date.		Place.	Obs time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837			s	m s		s	s	s	s	
August	13	Manargoody....	260,43	+ 3 49,0	88 8	—,569	— ,670	+ ,431	259 63	
,,	14	Puttoocottah	260,83	+ 3 49,0	88,0	,569	— ,670	,395	259 99	
,,	15	Munamelegoody	259.90	+ 3 49,0	85,8	,568	— ,688	,282	258.93	
,,	16	Kalehennary....	259.90	+ 3 49,0	87 6	,568	— ,688	,371	259,91	
,,	18	Ramnad....	260,43	+ 3 49,0	8[illegible].8	,569	— ,6[illegible]9	,434	259.61	
September	30	Paumban....	267.63	— 0 20,0	84.4	,581	+ ,064	,222	267.33	
August	20	Carryshandy....	260.57	+ 3 49.0	93,8	,569	— ,689	,686	260.00	
,,	21	Vadinatrum....	260.67	+ 3 49.0	96,0	,569	— ,689	,793	260,20	
,,	22	Powani	260 53	+ 3 49.0	89,8	,569	— ,6[illegible]9	,486	259,76	
September	26	Teutocorin	266,93	— 0 20,0	85,8	,582	— ,064	,294	266,71	
August	21	Pallamcottah....	256,13	+ 3 49.0	94,6	,561	— ,682	,713	255,60	13,87
September	22	———	269,60	— 0 21,5	87,7	,590	+ ,066	,395	269,47	
August	25	Nagracoil....	258,47	+ 3 48,0	86,6	,567	— ,684	,323	257,55	12,36
September	21	———	269,07	— 0 20,5	87,2	,589	+ ,065	,368	269,91	
August	28	Trivandrum	* 257,47	+ 3 46 5	84,7	,569	— ,684	,234	258,45	10,62
September	13	———	269,27	— 0 20,5	86,3	,589	+ ,065	,322	269,07	

* Immediately after marking this observation the cylinder accidentally dropped from my hand upon the ground, when it appeared, that an alteration in the time of making 100 vibrations to the amount of 10,00 seconds had taken place.

CLASS Ist. Cylinder J. C. No. 1.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837			s	m s	°		s	s	s	s
September	16	Trivandrum	204.67	— 0 1,0	86,6	— 452	0.000	,256	204,47 }	—0,40
November	22	”	204 37	0.0	84,0	,452	0,000	,156	204,07 }	
September	21	Nagracoil	203·37	— 20,5	86,5	,448	+ ,050	,251	203,22	
”	22	Pallamcottah	204.33	— 21,5	87,7	,451	.050	,297	204,23	
”	26	Teutocorin	202.93	— 21,5	85,0	,447	,050	,193	202,73	
”	30	Paumban	202.40	— 21,5	88,4	,445	,050	,321	202 33	
October	3	Negapatam	202.13	— 21,5	82.7	,445	,050	,104	201 84	
”	7	Tranquebar	202.33	— 21,5	92.0	,445	,050	,460	202.40	
”	10	Sheally	202.37	— 21,5	86,6	,445	,050	,252	202,23	
”	11	Porto Novo	201.83	— 21,5	92,6	,445	,050	,482	201,92	
”	12	Pondicherry	202.10	— 21,5	89 6	,445	,050	,364	202,07	
”	13	Allumparva	203.13	— 21,5	90.0	,448	,050	,386	203,12	
”	14	Sadras	200.83	— 21,5	86,0	,442	,050	,229	200,67	
”	16	Madras	202.12	— 21,5	86,2	,445	,050	,240	201,97	

CLASS Ist. Cylinder J. C. No. 2.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837										
September	20	Trivandrum	278,17	— 0 1,0	86,6	—,613	0,000	+0,318	277,91 }	+ 0,87
November	12	”	279,18	0.0	83,9	,615	,000	,208	278 78 }	
September	21	Nagracoil	277,30	— 20,5	86,0	,611	+ ,066	,316	277,07	
”	22	Pallamcottah	278,23	— 21,5	88,4	,613	,069	,445	278,13	
”	26	Teutocorin	276,00	— 21,5	85,0	,608	,069	,262	275,72	
”	30	Paumban	278,43	— 21,5	88,4	,613	,069	,445	277,33	
October	3	Negapatam	278,67	— 21,5	82,6	,613	,069	,136	278,26	
”	7	Tranquebar	278,60	— 21,5	91,8	,613	,069	,627	278,68	
”	10	Sheally	279.70	— 21,5	85 6	,616	,069	,297	279,39	
”	11	Porto Novo	278,73	— 21,5	93,0	,613	,069	.690	278,88	
”	12	Pondicherry	279,00	— 21,5	89,6	,614	,069	,509	278,96	
”	13	Allumparva	279,50	— 21,5	90,0	,615	,069	,533	279,49	
”	14	Sadras	277,30	— 21,5	86 0	,611	.069	,315	277,09	
”	16	Madras	277,85	— 21,5	86,2	,612	.069	,325	277,64	

A few days after my arrival at Madras, having completed the observations of Class I., I despatched the cylinders in a banghy parcel for *Cochin*, where they were met by Mr. Caldecott, for the purpose of making the observations which follow. In comparing the times of performing 100 vibrations at Trivandrum now observed, with those obtained when I left there, it appears that the Cylinder T. G. T. No 1, had diminished its intensity* by about 6 seconds, and No. 2 had diminished 1,2 seconds† in performing 100 vibrations; a circumstance which could only be expected, on considering the rough usage to which, in all probability, parcels are subjected by the banghy runners; such however is not the case with the other cylinder (No. 3), nor with J. C. Nos. 1 and 2; these last no doubt owe their invariableness to the rough usage to which I had previously subjected them—having performed at once what otherwise would have been performed by degrees.—In addition to the two cylinders J. C. No. 1 and No. 2, Mr. Caldecott had now constructed a third; which appears to have arrived at a fixed state of intensity; since, during 27 days (in which observations of this class were being made) its intensity diminished only 0, 19*s*. for 100 vibrations: this cylinder differed from the other two, in its length only; a circumstance which arose from its extreme brittleness, by which one end (about ½ an inch) broke off, in polishing, after it had been tempered.

* It is somewhat curious, although quite accidental no doubt, that

		s	
No. 1	has lost altogether	20,68	in performing 100 vibrations.
2	—— ——	20,27	
3	—— ——	20,54	

† This decrease of intensity in No. 2 is I think rather chargeable to other causes.

CLASS 2D.—Cylinder J. C. No. 1.

Date.	Place.	Obs. time of 100 vibrs.	Rate of Chronometer.	Faht. Thermometer.	Correction for Arc.	Correction for Rate	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837		s	m s	°	s	s	s	s	
September 16	Trivandrum	204,67	— 0,1,0	86,6	,452	0,00	+ ,258	204,48	
November 22	,, ...	204,37	0,0,0	84,0	,452	,00	+ ,156	204,07	
December 5	,, ...	203,97	0,0,0	79.1	,450	,00	— ,036	203,48	
November 15	Quilon	205,47	0,0,0	83,0	,453	,00	+ ,117	205,14	
,, 13	Allepee....	205,37	0,0,0	79,7	,453	,00	— ,012	204,91	
,, 9	Balghatty....	203,71	0,0,0	80,3	,449	,00	+ ,012	203,28	
,, 6	Chetwaye....	204,36	0,0,0	82,7	,450	,00	+ ,105	204,02	
,, 5	Penaney..	201,96	0,0,0	82,5	,445	,00	+ ,096	201,62	
,, 4	Calicut..	202,80	0,0,0	84,7	,446	,00	+ ,181	202,54	
,, 1	Tellicherry....	203,49	0,0,0	82,2	,448	,00	+ ,083	203,13	

CLASS 2D.—Cylinder J. C. No. 2.

Date.	Place.	Obs. time of 100 vibrs.	Rate of Chronometer.	Faht. Thermometer.	Correction for Arc.	Correction for Rate	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837									
September 20	Trivandrum	278,17	— 0,1,0	86,6	,613	0,00	+ ,349	277.91	
November 22	,, ...	279,18	0,0,0	83,9	,615	,00	,208	278.78	
December 5	,, ...	279,28	0,0,0	79,5	,616	,00	— ,026	278.64	
November 15	Quilon....	280,99	0,0,0	83,1	,620	,00	+ ,165	280.54	
,, 13	Allepee....	280,79	0,0,0	76,0	,619	,00	— ,214	279.96	
,, 9	Balghatty	278,85	0,0,0	80,3	,614	,00	+ ,016	278.26	
,, 6	Chetwaye	279,55	0,0,0	82,3	,616	,00	+ ,122	279.06	
,, 5	Penaney....	278,81	0,0,0	82,6	,614	,00	+ ,138	278.34	
,, 4	Calicut....	279,28	0,0,0	84,9	,616	,00	+ ,261	278.93	
,, 1	Tellicherry....	279,91	0,6,0	84,7	,617	,00	+ ,250	279.55	

CLASS II, Cylinder J. C. No. 3.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837			s	m s	°	s	s	s	s	
October	7	Trivandrum	211,91	— 0 0,0	—80.7	,473	0,00	+,029	214,47	
,,	26	,,	215.47	0,0	81,6	,475	,00	+,189	215,19	
November	22	,,	215,86	0,0	79,8	,475	,00	—,012	215,38	
December	5	,,	216,06	0,0	81,1	,475	,00	+,188	215,78	
November	15	Quilon	217,46	0,0	83,5	,479	,00	+,146	217,13	
,,	13	Allepee	217.36	0,0	76 7	,479	,00	—,136	216,75	
,,	9	Balghatty	214,76	0,0	79,5	,473	,00	—,021	214,27	
,,	6	Chetwaye	215,36	0,0	81,7	,474	,00	+,070	214,96	
,,	5	Penaney	214,57	0,0	83,0	,472	,00	+,123	214,23	
,,	4	Calicut	214,23	0,0	84,0	,471	,00	+,164	21[illegible].93	
,,	1	Tellicherry	214,60	0,0	83,7	,472	,00	+,152	214,28	

CLASS II, Cylinder T. G. T. No. 1.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837										
September	16	Trivandrum	274,29	— 0,20,5	86,4	,604	+0,064	+,332	273,99	
November	22	,,	280,[illegible]8	0,0	84,9	,617	,000	+,261	279,83	
December	5	,,	280,08	0,0	80,0	,617	,000	+,000	279,47	
November	15	Quilon	281,38	0,0	82,7	,621	,000	+,144	280,91	
,,	13	Allepee	281,58	0,0	77,4	,622	,000	—,138	280.82	
,,	9	Balghatty	279.25	0,0	82,0	,615	,000	+,106	278.75	
,,	6	Chetwaye	280 31	0,0	80,8	,618	,000	+,043	279.74	
,,	5	Penaney	278,78	0,0	83,3	,615	,000	+,173	278.34	
,,	4	Calicut	278,56	0,0	87,0	,614	,000	+,370	278,34	
,,	1	Tellicherry	279,11	0,0	82,9	,615	,000	+,155	278,65	

CLASS IID.—Cylinder T. G. T. No. 2.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
1837			s	m s	°	s	s	s	s	
September	16	Trivandrum	293,80	− 0,20,5	86,3	,647	+ 0,070	+ ,351	293,57	
November	22	"	295,09	0, 0,0	85,0	,648	,000	+ ,275	294,72	
December	5	"	293,79	0,0	80,0	,615	,000	,000	293,15	
November	15	Quilon	294,59	0,0	82,0	,616	,000	+ ,112	294,06	
do.	13	Allepee	294,99	0,0	78,6	,648	,000	− ,078	294,26	
do.	9	Balghatty	292,46	0,0	83,3	,611	,000	+ ,182	292,01	
do.	6	Chetwaye	293,03	0,0	81,1	,642	,000	+ ,061	292,45	
do.	5	Penaney	292,86	0,0	83,0	,612	,000	+ ,167	292,38	
do.	4	Calicut	293,29	0,0	83,7	,613	,000	+ ,205	292,86	
do.	1	Tellicherry	294,24	0,0	82,8	,616	,000	+ ,156	293,75	

CLASS IID.—Cylinder T. G. T. No. 3.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80. Temperature	Difference.
September	13	Trivandrum	269,27	− 0,20,5	86,3	,589	+ ,065	+ ,322	269,07	
November	22	"	268,28	0,0	85,2	,591	,000	+ ,261	267,96	
December	5	"	267,58	0,0	79,9	,589	,000	− ,005	266,99	
November	15	Quilon	269,78	0,0	82,0	,593	,000	+ ,102	269,29	
do.	13	Allepee	269,88	0,0	79,5	,594	,000	− ,026	269,26	
do.	9	Balghatty	267,41	0,0	83,4	,589	,000	+ ,170	267,00	
do.	6	Chetwaye	267,95	0,0	80,8	,590	,000	+ ,407	267,77	
do.	5	Penaney	267,61	0,0	82,9	,589	,000	+ ,148	267,17	
do.	4	Calicut	266,88	0,0	83,7	,587	,000	+ ,185	266,48	
do.	1	Tellicherry	267,73	0,0	82,7	,589	,000	+ ,136	267,28	

N. B.—The observations at Tellicherry were made in a thatched room, on the bastion, behind the master attendant's house.

CLASS III.

Immediately after making the above observations, which were performed altogether by Mr. Caldecott, he despatched the cylinders to Madras, for the purpose of enabling me to make the observations to the north of this place; the carriage of them was necessarily effected as before by the banghy runners; save that Mr. Caldecott had taken the precaution to place the cylinders in grooves cut in a little box, made on purpose for their reception; and the whole was tightly secured by cotton. Notwithstanding this precaution, on the arrival of the box at Madras, the cylinders were all found huddled together in one corner of the box, the insufficient quantity of cotton which remained, allowing them to play about in any manner they pleased; it was in fact but too evident that the box had been opened to ascertain its contents, and had not been packed again with anything like care. Thus circumstanced, the needles, which had necessarily lost a considerable degree of intensity, were now employed during two months by my assistant *Tannyachellum*, by way of learning; when, finding that during this time they bore rough handling without losing any portion of their intensity, on the 21st April I despatched them by *Tannyachellum* to Ongole, when the following observations were made :—

CLASS IIId.—Cylinder T. G. T., No. 1.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermo-meter.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80 Temperature	Mean.
			s	m s	°	s	s	s	s	s
1838 April	20	Madras	283,00	— 0,18,5	86,0	— ,623	+ ,060	+ ,060	282,50	282,37
June	16	,,	282,30	— 0,18,5	89,5	,622	,060	+ ,509	282,25	
1839 January	17	,,	282 78	— 0, 0,5	79,0	,623	,000	— ,053	282,10	
1838 April	29	Poodaway	283,33	— 0,18,5	95,0	,624	+ ,060	+ ,807	283,57	284,03
June	7	,,	284,43	— 18,5	9 ,7	,626	,060	,632	284,50	
May	7	Sooloorpet	283,40	— 18,5	101,0	,621	,060	1,184	284,02	284,85
June	3	,,	285,67	— 18,5	100,5	,629	,060	0,572	285,67	
May	9	Woogilly	283,43	— 18,5	99,5	,624	,060	,512	283,38	283,87
June	1	,,	281,55	— 18,5	97,0	,626	,060	,379	284,36	
May	12	Nellore	283,53	— 18,5	102,5	,621	,060	,672	283,64	284,57
do.	29	,,	285,67	— 18,5	87,5	,629	,060	,406	285,51	
do.	14	Alloor	284,20	— 18,5	106,7	,625	,060	1,411	285,08	285,53
do.	27	,,	285,60	— 18,5	97,5	,628	,060	0,955	285,99	
do.	16	Ramapatam	284,53	— 18,5	108,5	,626	,060	1,542	285,51	285,51
do.	23	,,	285,50	— 18,5	90,7	,628	,060	0,578	285,51	
do.	19	Ongcle	282,93	— 18,5	96.7	,623	,060	,899	283,27	283,88
do.	20	,,	281,17	— 18,5	96,0	,625	,060	,866	284,49	

CLASS IIID.—Cylinder T. G. T., No. 2.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80 Temperature	Mean.
			s	m s	°	s	s	s	s	s
1838 April	20	Madras	312,93	— 0,18,5	85,2	— ,688	+ ,067	+ ,312	312,62	312,31
June	16	,,	312,05	— 0,18,5	90,0	— ,686	,067	,580	312,01	
1839 January	17	,,	311,47	— 0, 0,5	85,0	,685	,067	,282	311,13	
1838 April	29	Poodaway	312,40	— 0,18,5	93,5	,687	,067	,786	312,57	312,86
June	7	,,	313,07	18,5	91,7	,688	,067	,697	313,15	
May	7	Sooloorpet	314,57	18,5	102,0	,692	,067	1,375	315,32	315,18
June	3	,,	314,10	18,5	105,0	,690	,067	1,562	315,04	
May	9	Woogilly	311,87	18,5	104,0	,686	,067	1,378	312,63	313,49
June	1	,,	313,93	18,5	97,0	,690	,067	1,039	314,35	
May	12	Nellore	313,00	18,5	102,5	,688	,067	1,326	313,71	313,37
do.	29	,,	313,17	18,5	88,0	,688	,067	0,478	313,03	
do.	14	Alloor	313,70	18,5	106,0	,689	,067	1,578	314,66	314,80
do.	27	,,	314,50	18,5	97,0	,691	,067	1,057	314,93	
do.	16	Ramapatam	313,60	18,5	106,5	,689	,067	1,598	314,58	314,35
do.	23	,,	314,20	18,5	90,7	,690	,067	0,655	314,13	
do.	19	Ongole	314,10	18,5	97,0	,690	,067	1,045	314,52	313,97
do.	20	,,	313,10	18,5	96,0	,688	,067	0,950	313,43	

CLASS IIId.—Cylinder T. G. T. No. 3.

Date.		Place.	Obs. time of 100 vibrs.	Rate of Chronometer	Thermometer.	Correction for Arc.	Correction for Rate.	Correction for Temp.	Time of 100 vibrs. at 80 Temperature	Mean.
			s	m s		s	s	s	s	s
1838 April	20	Madras	277,10	— 0,18,5	85,0	— ,610	+ ,058	+ ,263	276,81 }	276,96
June	17	„	277,13	— 0,18,5	90,5	,611	,058	,554	277,13 }	
1839 January	17	„	277,70	— ,0 0,5	85,1	,612	,058	,268	277,41	
1838 April	29	Poodaway	277,77	— 18,5	95,0	,612	,058	,792	278,01 }	278,36
June	7	„	278,67	18,5	91,5	,614	,058	,609	278,72 }	
May	7	Sooloorpet	277,40	18,5	102,0	,611	,058	1,162	278,01 }	279,13
June	3	„	279,40	18,5	106,7	,616	,058	1,418	280,26 }	
May	9	Woogilly	277,05	18,5	102,0	,610	,058	1,157	277,65 }	278,50
June	1	„	279,00	18,5	97,0	,615	,058	,901	279,34 }	
May	12	Nellore	278,31	18,5	102,5	,612	,058	1,190	278,95 }	278,66
do.	29	„	278,50	18,5	88,0	,614	,058	,421	278,37 }	
do.	14	Alloor	279,95	18,5	106,0	,617	,058	1,383	280,77 }	279,95
do.	27	„	278,80	18,5	96,5	,615	,058	,872	279,12 }	
do.	16	Ramapatam	278,10	18,5	105,5	,612	,058	1,320	278,87 }	279,03
do.	23	„	279,20	18,5	90,5	,615	,058	,557	279,20 }	
do.	19	Ongole	278,21	18,5	97,5	,612	,058	,923	278,58 }	279,54
do.	20	„	280,15	18,5	97,0	,617	,058	,905	280,50 }	

To deduce from these values of the times occupied by each cylinder to perform 100 vibrations, the relative horizontal magnetic intensities at the several places: let T represent the time of any needle performing 100 horizontal vibrations at *Madras;* and T′, the time occupied by the same needle, to perform 100 vibrations at any other place, and let h, and h' represent the horizontal intensities at those places: then we get

$$\frac{h}{h'} = \left(\frac{T'}{T}\right)^2.$$

Applying this formula to the *Madras* and *Trivandrum* observations, and putting $h = 1$ we have

	T.G.T. 1.	T.G.T. 2.	T.G.T. 3.	J. C. 1.	J. C. 2.
Madras........	273,98	291,41	266,08	201,97	277,64
Trivandrum.... {	274.50	294.31	———	204,47	277,91
	273,99	293,57	269,07	204,07	278,78
h' = ...	0,998032	0,982860	0,977899	0,977608	0,994905

Mean value of h' = ,98626

Assuming h' as just found, if we now compare the observations made between *Vadinatrum* and *Tellicherry* with those made at *Trivandrum;* and (recollecting that $h = 1$,) compare the observations at the remaining stations with those made at *Madras,* we get altogether as follows:—

TABLE IV.

A table of the observed horizontal Magnetic force relative to Madras assumed = 1.

Place.	T. G. T. 1	T. G. T. 2	T. G. T. 3	J. C. 1.	J. C. 2	J. C. 3	Mean.
Ongole	0,9894	0,9894	0,9816	......	......	......	0,9868
Ramapatam	,9781	,9870	,9852	......	......	......	,9834
Alloor	,9780	,9842	,9790	......	......	......	,9804
Nellore	,9846	,9933	,9878	......	......	......	,9886
Woogilly	,9895	,9925	,9890	......	......	......	,9903
Sooloorpet	,9827	,9819	,9845	......	......	......	,9830
Poodaway	,9883	,9965	,9900	......	......	......	,9913
Madras	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
Sadras	1,0101	,0052	1,0036	1,0130	,0040	......	1,0072
Allumparva	0,9965	,9964	,9961	,9887	,9868	......	0,9929
Pondicherry	0,9996	,9978	,9990	,9990	,9906	......	,9972
Porto Novo	1,0017	,9981	,9899	1,0005	,9911	......	,9962
Sheally	0,9962	,9977	,9893	0,9974	,9875	......	,9936
Tranquebar	0,9984	,9928	,9887	0,9958	,9926	......	,9937
Negapatam	1,0037	,9988	,9797	1,0012	,9956	......	,9958
Manargoody	......	......	,9773	......	......	......	,9773

TABLE IV—*continued.*

A table of the observed horizontal Magnetic force relative to Madras assumed = 1.

Place.	T. G. T. 1	T. G. T. 2	T. G. T. 3	J. C. 1.	J. C. 2	J. C. 3	Mean.
Puttoocottah	......	......	,9746	......	......	......	,9746
Munamelegoody	......	......	,9826	......	......	......	,9826
Kalehennary	......	......	,9820	......	......	......	,9820
Ramnad	......	......	,9775	......	......	......	,9775
Paumban	,9857	,9972	,9952	,9964	1,0023	......	,9953
Carryshandy	......	......	,9745	......	......	......	,9745
Vadinatrum	......	......	,9730	......	......	......	,9730
Powani	......	......	,9763	......	......	......	,9763
Teutocorin	,9842	,9854	1,0038	1,0021	1,0020	......	,9955
Pallamcottah	,9888	,9776	,9970	,9366	,9847	......	,9869
Nagracoil	,9862	,9877	,9866	,9965	,9923	......	,9898
Trivandrum	,9771	,9863	,9863	0,9863	,9863	,9863	,9363
Quilon	,9774	,9854	,9685	,9824	,9739	,9695	,9762
Allepee	,9780	,9840	,9687	,9801	,9780	,9729	,9769
Balghatty	,9926	,9993	,9844	,9959	,9899	,9956	.9929
Chetwaye	,9856	,9963	,9840	,9887	,9843	,9892	,9880
Penaney	,9956	,9967	,9839	1,0123	,9894	,9960	,9956
Calicut	,9958	,9935	,9890	1,0032	,9852	,9987	,9942
Tellicherry	,9934	,9875	,9831	0,9974	,9808	,9955	,9896

These results appear, on the whole, as accordant as results from intensity observations generally come; for, independent of the known corrections and unavoidable errors which occur to observations of this nature, there are without doubt others of whose disposition we are ignorant; a fact, that will be rendered sufficiently obvious by consulting the foregoing observations, in which the greatest error of observation from *known causes*, I estimate can never amount to 4-tenths of a second of time; under these circumstances it will be turning the above results to the best account, if we now deduce the intensity of the magnetic equator; for, thus employed, we may fairly hope to get rid of errors of every kind. To arrive at the most accurate result, we must here have recourse to theory; and although the theory that the tangent of the dip is equal to twice the tangent of the magnetic latitude ($tan.\ \delta = 2\ tan.\ \lambda$) is derived from principles which appear, all circumstances considered, to be not strictly true; still, for the small space over which we have occasion to employ it, and that only in a differential sense, its accuracy is fully equal, and indeed superior, to our wants. If to the above formula we add, that, $h = A \cos. \lambda$, where A represents the *total* magnetic force; we arrive, after a little reduction, at the expression

$$h = 2\,A\sqrt{\frac{1}{3 + \sec.^2\delta}}\ ;$$

from which we will now compute the

Total intensity of the Magnetic force at the Magnetic Equator, horizontal force at Madras = 1.

Place.	Observed values of A.	Mean value.	Difference.
Ongole	0,9920	0,9921	— ,0001
Ramapatam	,9879	....	— ,0042
Alloor	,9845	....	— ,0076
Nellore	,9922	....	+ ,0001
Woojilly	,9933	....	+ ,0012
Sooloorpet	,9856	....	— ,0065
Poodaway	,9933	....	+ ,0012
Madras	1,0019	....	+ ,0098
Sadras	,0082	....	+ ,0161
Allumparva	0,9938	....	+ ,0017
Pondicherry	,9980	....	+ ,0059
Porto Novo	,9966	....	+ ,0045
Shealy	,9939	....	+ ,0018
Tranquebar	,9939	....	+ ,0018

Place.	Observed values of A.	Mean value.	Difference.
Negapatam...........	,9959	,09921	+ ,0038
Manargoody...........	,9774		
Puttoocottah........	,9747		
Munamelegoody.....	,9826		
Kalhennary,.........	,9821		
Ramnad............	,9775		
Paumban.......	,9953	....	+ ,0032
Carryshandy.... ...	,9748		
Vadinatram.........	,9730		
Powani.............	,9763		
Teutocorin..........	,9958	....	+ ,0037
Palamcottah	,9872	....	— ,0049
Nagracoil...........	,9898	... .	— ,0023
Trivandrum....	,9867	....	— ,0054
Quilon...............	,9765	....	— ,0156
Allepee.................	,9771	....	— ,0150
Balghatty.......	,9929	....	+ ,0008
Chetwaye	,9882	....	— ,0039
Penaney..	,9958	....	+ ,0037
Calicut.............	,9946	....	+ ,0025
Tellicherry.........	.9901	....	— ,0020

If to each of the above values we were to give a weight proportionate to the number of cylinders employed, we should obtain a mean value possessing the least probable error of observation; but, since in this case the errors due to local causes would not be fairly dealt by, it becomes a question—if a more correct mean value would not be attained, by taking the mean without reference to the number of observations employed; to pursue a middle course, however, we may safely give

to 1 observation a weight 1
— 3 or 4 —— —— 2
and — 5 or 6 —— —— 3

(when, assuming the horizontal intensity at Madras = 1.)

The total magnetic force at the magnetic equator = ,9906
or, rejecting the observations at eight stations made *only* with cylinder T. G. T. No. 3, we get the horizontal intensity of the magnetic equator = ,9921 :—On comparing this with the several constituent values, we obtain the column " difference ;" exhibiting the amount of error of observation, mixed up with the effect of local disturbances; the largest of these (that at Sadras), might possibly be accounted for by

the granitic formations there met with (the Sadras hills), but *if so*, Palamcottah and Nagracoil (at which places similar but larger causes for disturbance exist) ought to shew the same; whereas they exhibit a very small, but opposite, tendency. Or it would appear on the whole, *that the distribution of magnetic intensity in Southern India is but little interfered with by local causes*; and, with reference to Madras, that the location chosen for making the observations exhibits an intensity in excess, to the amount of 1,0098 to 1.

Assuming this, we will now compare the magnetic intensity of Madras, and of the magnetic equator with that of London; for which purpose we have the following observations made with the two intensity cylinders belonging to Captain D. Bethune, already adverted to at the commencement of this paper. The observations in London were, I presume, made by Captain Bethune, whereas those at Madras in 1837 were made by Capt. B. and myself conjointly, and those in 1839 by myself alone.

Mean time occupied by Cylinder No. 3 × and No. 3 in making 10 vibrations, at the temperature of 60°.

Date.	at Madras. No. 3 ×	at Madras. No. 3	in London. No. 3 ×	in London. No. 3
			s	s
In the year 1835			442.76	461.96
1837.	s	s		
April 30 } May 3 }	300.30	309.74		
1839.				
Jan. 29	303.26	310.83		

A mere glance at these numbers, shews that one, if not both of the cylinders, had diminished its intensity at the time of making the first observations at Madras; and that after twenty-one months (when the second observations were made) they had still further diminished their intensities No. 3 ×, by 2.96*s* and No. 3, by 1.09*s*; hence it would appear probable that in 1835, when the *London* observations were made, these cylinders, with their then stronger intensities, at *Madras* would have performed 100 vibrations in something like 294*s* and 307*s* respectively: as the numbers now stand (recollecting that $\frac{h}{h'} = \left(\frac{T'}{T}\right)^2$; and putting $h = 1$ for the horizontal intensity of London)

we get from cylinder No. 3 × ; $h = 2.174$
and ——— No. 3 $h' = 2.225$—

whereas, from the somewhat probable numbers we have just assumed,

cylinder No. 3 × gives $h, = 2.268$
No. 3 — $h = 2.264$

The latter numbers, if admitted, now remain to be diminished in the proportion of 1.0098 to 1.0000 for the local influence at Madras; when, with reference to the formula at page 269, we get

	Horizontal Intensity.	Total Intensity.
in London.	1	1
Magnetic Equator Longitude 79° E.	2.259	,8065

In conclusion, I cannot but feel regret that I have devoted so much space to the discussion of observations, which in the end have furnished results of but comparatively little importance; but, viewing these observations as a part only of a series, which will probably ere long be extended to the most northern limits of India, and perhaps some parts of Persia, it becomes a question, whether, on the whole, they are not just what could be desired.

Madras Observatory,
9th March, 1839.

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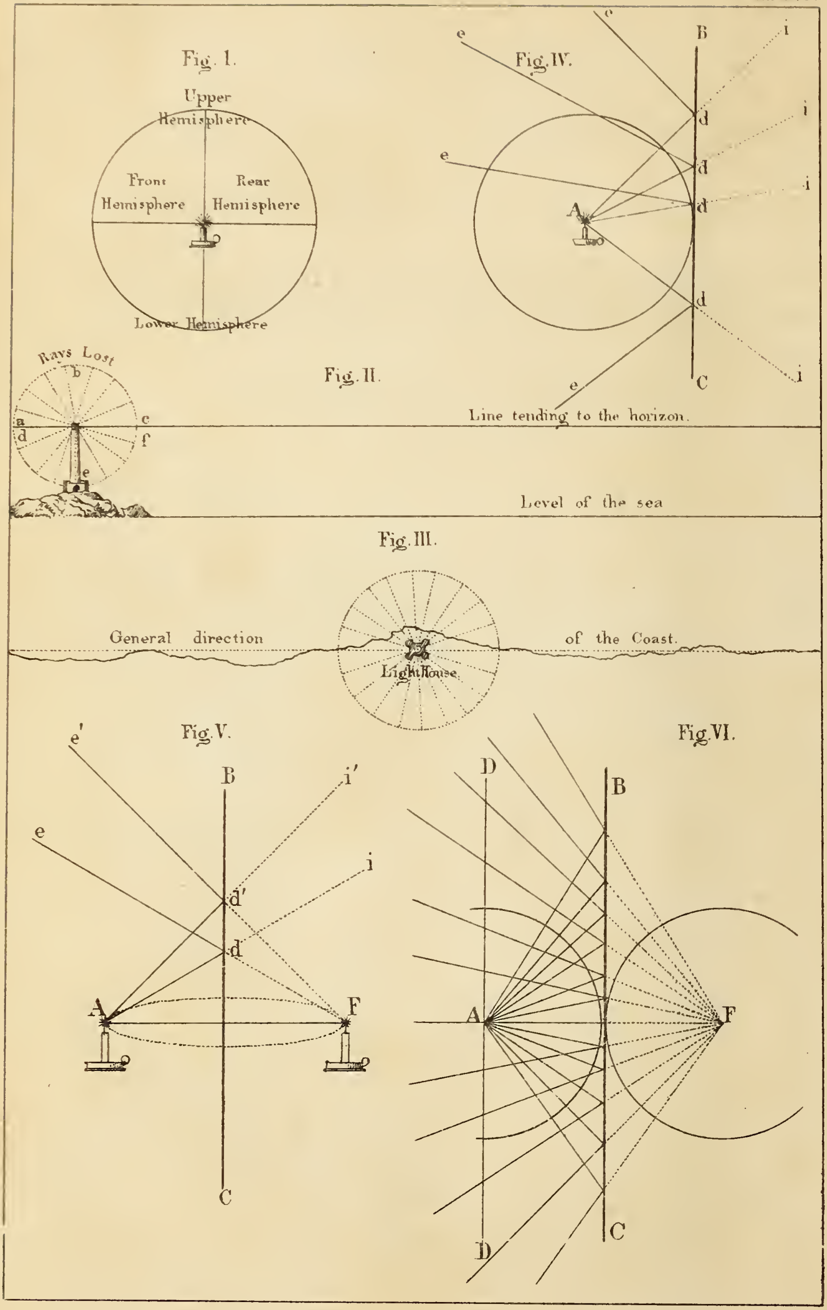
Fig. I.
Upper Hemisphere
Front Hemisphere
Rear Hemisphere
Lower Hemisphere
Fig. IV.
e
e
e
e
B
d
d
d
d
i
i
i
i
A
C
Rays Lost
a
b
c
d
e
f
Fig. II.
Line tending to the horizon.
Level of the sea
Fig. III.
General direction of the Coast.
Light House
Fig. V.
e'
e
B
i'
i
d'
d
A
F
C
Fig. VI.
D
B
A
F
C
D

III.—*An Investigation of the Nature and Optical efficiency of the combination of Mirrors used to augment the illuminating power of the Madras Light.—By Captain* J. T. Smith, *Engineers, F. R. S.*

To the Editor of the Madras Journal of Literature and Science.

Sir,

On looking through some old papers, I have met with, and have the pleasure to send you the accompanying essay, which was written in the year 1833, with a view to publication, but which from accidental causes was then laid aside. As the subject has more of a local than general interest, and as the evils which are herein pointed out are likely to be soon remedied, I should not now have ventured to request you to give it insertion in your pages, were it not possible that some benefit might result from an exhibition of the defects of a contrivance, which has hitherto been but little studied, and has been supposed by some to possess considerable merit for its simplicity; at a time when the increasing intercourse between the different parts of India, and the urgent demand for the better illumination of our coasts, renders the adoption of a correct theory, and more efficient means, every day more and more desirable.

The analysis which forms the chief object of this paper, owes its origin to an enquiry in which I was engaged at the time I have mentioned, some scattered memoranda of which were collected and arranged in the way in which they now stand; and, in order to introduce the subject to the perusal of the general reader, I have thought it necessary to premise a few general observations on the distribution of light, and the nature and objects of Light-house illumination, together with a few remarks upon the leading principles by which the latter is governed; a distinct understanding of them being almost indispensable to a clear explanation of the mode of investigation which has been adopted.

Madras, *December 8th*, 1838.

Preliminary Observations.—Every luminous point whatever throws out rays in all directions, and is equally visible at the same *distance* in every possible situation. This may be illustrated, by supposing it placed in the centre of a hollow sphere, every portion of the surface of which would receive an equal number of its rays, and be equally illuminated by it.

I shall have occasion hereafter to speak of the upper half of this sphere as the upper hemisphere of rays (Fig. 1 Pl. 3), and the lower half as

the lower hemisphere. In the same manner, of two other similar divisions of it, formed by a plane perpendicular to the former, (which is supposed to be horizontal) as the front and rear hemispheres, as regards the situation of the light in reference to a reflector or any particular object. The rays proceeding *directly* from a luminous body to the eye, and thus visible, may be termed the original or *direct* light, in contradistinction to that visible after *reflection* from any bright surface.

Under most of the circumstances in which light is usually required, as for instance, in illuminating apartments &c. the whole of the rays of direct light, corresponding to every part of the above sphere, are of equal value, those proceeding in an upward direction serving to illuminate the ceiling and upper parts of the room, and those proceeding in a direction *from* the eye, being reflected from other objects and rendering *them* visible; the intention being in this case, to afford as much light as possible to the various objects placed in different situations round the luminous body, and not particularly to throw a large quantity towards the eye; as it is not the *light*, but the *objects*, which it is most desirable should be seen.

In a Light-house, however, the case is just the reverse, for there are here *no* objects whatever to be illuminated, the great point to be attained being to throw as much light as possible to the observer. Now as it is evident that in respect to a luminous body placed in a Light-house the eye can never be situated in any part of the *upper* half of the sphere of rays above alluded to, since the line connecting the light and the horizon would be barely even horizontal, it follows that the whole of those rays must be entirely lost. If the Light-house from being insulated be required to illuminate the circumference of the horizon all round, nearly all the remaining, or lower half of the sphere of rays, will be effective, as those which fall below the horizon line will be visible from points nearer to the light, and consequently forming an angle of depression with it; and the only rays of the lower hemisphere lost will be those intercepted by the brick work of the building itself. This will I hope be clearly understood by a reference to Fig. 2 which represents a vertical section of a Light-house situated as above supposed, and in which the unserviceable rays, or those lost in consequence of their emanating in directions *above* the level of the horizon, are comprised within the semicircle *a b c* (which is the *section* of the upper hemisphere before spoken of) while the serviceable rays, or those which are visible from points at different distances from the building, are included within the lower semicircle *d e f*.

In many instances, however, illumination may be required to extend

to only half of the whole circumference of the horizon, which is frequently the case when the situation of the Light-house is on the edge of a straight line of coast, (as at Madras) and it is required merely to be visible from the sea. Under these circumstances, it is evident, that only a half of the before mentioned hemisphere of *serviceable* rays are available for the purpose required, since all that emanate towards the opposite hemisphere fall in rear of the line of coast, and are consequently entirely useless, as exhibited in figure (No. 3). In other words, in such a situation, out of the whole sphere of rays proceeding from the luminous object, one half is lost owing to their being projected in directions *above* the horizon, and one half *of the remaining half* by falling in rear of the line of coast.

In other cases, when the situation is such as to require a greater or less portion of the circumference of the horizon to be illuminated, as for instance, if the Light-house be placed upon a promontory, or within a channel or harbour, the ratio of the serviceable rays to the whole illuminating power of the lower hemisphere will be in proportion to the extent of that part of the circumference whence they are required to be seen, to the whole periphery of the circle. When this ratio is one half, or 180° the proportion of the rays from which benefit is derived is as before stated, one half of the inferior hemisphere, shown in Fig. 2, or $\frac{1}{4}$ of the whole of the rays proceeding from the luminous body, no advantage whatever being derived from the remaining three-fourths.

The great loss of light here shown to occur in situations similar to that of the Madras Light-house, has led amongst other contrivances, to the invention of metallic and glass mirrors for the purpose of reflecting as many as possible of these truant rays, by diverting them from their natural directions into others in which they would be visible.

These mirrors may be either plane or curved.

It is my intention in this paper merely to consider the properties of plane mirrors, with a view of estimating the assistance they afford when arranged in the manner in which they are at present applied in the Madras Light-house, my object in selecting that work being principally to put an end to all doubts as to the possibility of great improvement in it, and at the same time, if possible, to lead the way to the rejection and removal of a clumsy contrivance, by demonstrating the extreme inefficiency of the arrangement, and tracing it to its proper causes.

Previous, however, to entering upon this investigation, it is necessary to prepare the way for it by a brief attention to a few of the fundamental laws of optics upon which it is founded, and which I hope I shall be ex-

cused for taking notice of in this place, as although devoid of novelty and interest to the scientific reader, they are nevertheless indispensable to a proper understanding of what follows, by those who may have devoted less of their time and attention to the subject.

When the rays of light proceeding from a luminous point are reflected from a plane, they proceed *after* reflection in lines which will slope as much *from* the plane as they before sloped *towards* it.—Namely, if A *d*, A *d′* (Fig. 5) be any rays of light proceeding from a point A and striking a plane B C, they will *after* reflection slope *from* the plane at angles B *d e*, B *d′ e′*—equal to the angles A *d* C, A *d′* C at which they before sloped *towards* it. Hence it may be easily deduced that the obliquity of the rays *d e*, *d′ e′*—from the *front* of the plane is exactly the same as that of the lines *d i*, *d′ i′*, in which they would have proceeded to the *rear* of it if not intercepted. The effect of the reflection being exactly the same as of the light at A were turned half round an imaginary axis B C to a new position at F, so that the rays proceeded to the front instead of the rear of plane as shown in the figure.

It must also be remarked, that the divergence of the rays with respect to one another remains unaltered, the angle *e f e′* being in every case unchanged, and continuing equal to the angle *i a i′*, the effect being merely to *reverse* the whole of the rays composing the hemisphere of light next the plane, without in the least interfering with their relative inclinations.

If we now suppose a plane polished surface to be placed immediately in rear of the imaginary sphere of light before spoken of, it will be easy to understand from what has just been explained, that its effect would be to turn the whole* of the rays comprised in the rear hemisphere, and cause them to proceed in directions exactly similar to those pursued by the rays emanating from the front one. In applying this to the aid of Light-house illumination, therefore, such a contrivance, would, in cases when only half of the circumference of the horizon is required to be illuminated, *double* the useful light, by in fact converting one complete sphere of luminous rays into *two front*, instead of one front, and one rear hemisphere.

What has been hitherto said has referred only to a single luminous *point* infinitely small, but as the same is equally true regarding every point constituting a body of light of any size, it follows that in every situation from which it has been shown that the rays from a single point

* This of course supposes the plane to be unlimited in extent, as the rays nearest the diameter AD would not meet it, except at an infinite distance. In practice, therefore, the *whole* of the rays cannot be returned by a plane mirror, for the same is true also when taken in a *lateral* direction, and the number lost will depend upon the size of the plane and its distance from the radiant point.

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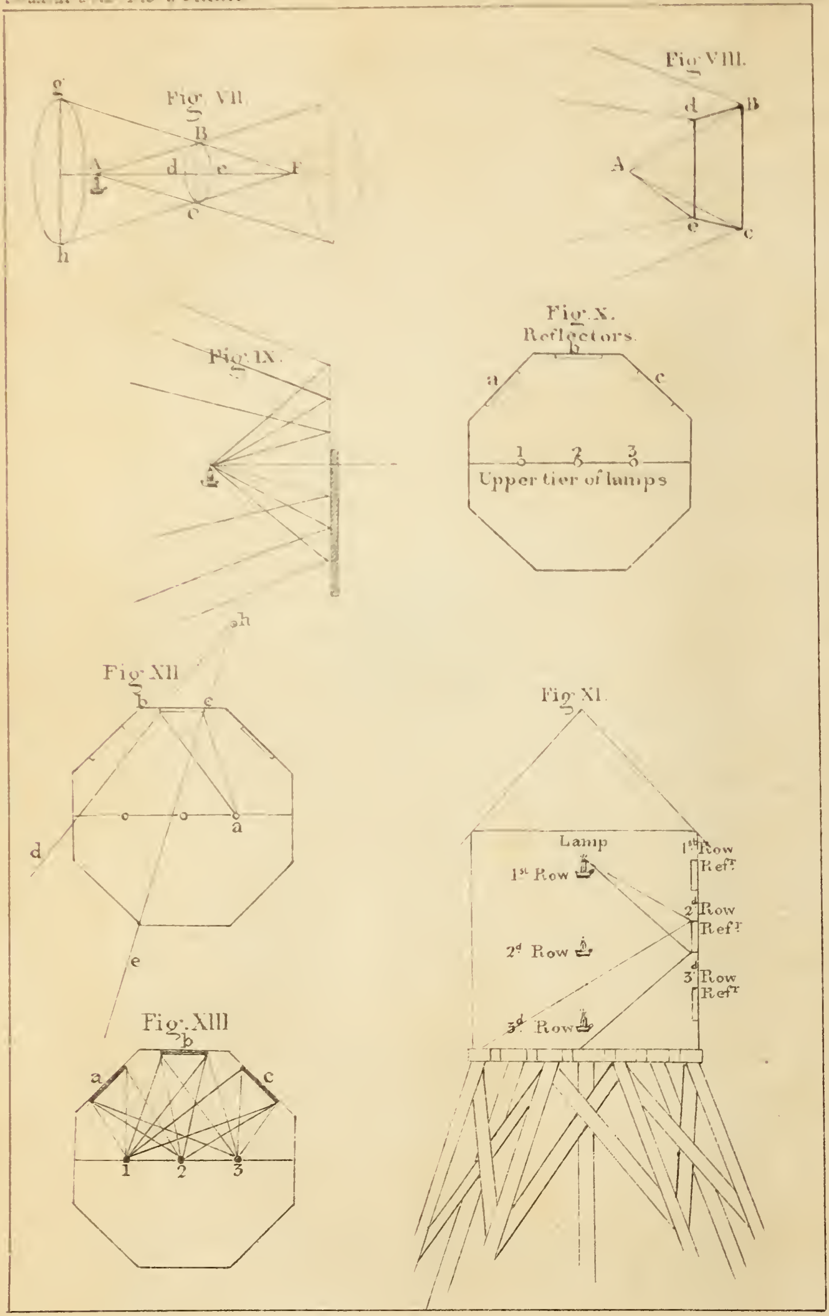


Fig. VII.
g
B
A
d
e
F
c
h
Fig. VIII.
d
B
A
e
c
Fig. IX.
h
Fig. X.
Reflectors.
b
a
c
1
2
3
Upper tier of lamps
Fig. XII
b
c
a
d
e
Fig. XI.
Lamp
1st Row
1st Row Refr
2d Row
2d Row Refr
3d Row
3d Row Refr
Fig. XIII
b
a
c
1
2
3

would be visible, in the same situations the rays from the other points would also be seen, constituting *images* of the flame or luminous body, of whatever kind.

In this manner an image of a candle will be seen by reflection from a circular looking glass or mirror, in all those situations embraced by a cone of rays proceeding from it in the directions pointed out by the above law—namely, if A (Fig. 7 Pl. 4) be the light, and B C a circular plane mirror, a reflected image of A will be visible from any point within the frustum of the cone B C *g h*, formed by the reflection of the rays impinging on the circular area B *d* C *e*.

If the mirror be *square* then a reflected image of the light will be visible in any part of the *pyramid* of rays, formed in the same way, as shown in Fig. 8.

From what has been said in the former part of this paper, taken in connection with these circumstances, it will be easily seen, that in order to produce the utmost beneficial effect, no part of a plane mirror, if placed vertically, ought to be above the uppermost part of the light to which it is adapted, as in that case, the rays which would be reflected from that part of it, would be those belonging to the *upper* hemisphere, which I have already shown to be useless (vide Fig. 9). I am not aware whether this circumstance has been attended to in the disposition of the reflectors in the Madras Light-house, having never examined the apparatus, but I shall suppose such to be the case, and that they are disposed to the greatest advantage they are capable of, as even were it not so, it is a defect which could be very easily remedied, and it is my object to show, not that a bad use has been made of efficient means, but that the contrivance itself, under the best arrangement, is of much less value and assistance than has generally been supposed.

I shall now proceed to a description of the lantern of this Light-house, and to dissect the operation of, and calculate the value, of the assistance rendered by the reflectors contained in it. In doing this, I shall as I before stated, suppose every mirror to be placed in the most advantageous position (with regard to height), viz., so that the image reflected from the *upper* portion of it is visible on the edge of the horizon, and that the lower portions in turn, successively, afford light to the points nearer to the building itself.

The shape of the lantern is an octagon, three sides of which, towards the land, are opaque, and the remaining five sides glazed. On the three first opaque sides are placed the reflectors, in three rows, one above the other; they are squares of one foot each side, of looking-glass, and occupy the centre of each of the sides of the polygon as shown in the plan Fig. 13.

The lamps, which are 12 in number, are also arranged in three tiers, corresponding to those in which the mirrors are placed, but the number in each row is not the same, that of the top row being 3, in the second 4, and in the third 5.

From the accompanying section (Fig. 11) it is evident, that no assistance whatever is derived by any lamp, from any of the mirrors except those in the *same tier* with itself, an inspection of the figure showing at once, that the image reflected from a mirror situated in the row *beneath* the lamp, would be merely visible at the very foot of the Light-house, even if it did not fall within the limits of the building itself; and I have before said enough to explain, that no benefit whatever would be derived by any aid from a mirror in the tier *above* it, all the rays of which would strike the roof of the lantern, or be lost in the air. It is unnecessary therefore to pay any attention to the operation of the reflectors, with reference to any of the lamps except those belonging to the same tier, and I shall therefore proceed to enquire into the aid afforded by those in each row to every lamp belonging to it, in turn; and admitting the very favourable assumption before alluded to, that the images when visible at any point on the horizon, will also be visible at every point in a direct line between it and the Light-house, shall now measure the extent of the circumference in a *lateral* direction through which this effect will take place.

In order to calculate this, it is merely necessary to consider, that the reflected image of any one of the lamps, will, as before explained, be visible in each mirror merely within the limits embraced by the pyramid of rays reflected from its surface, and also, that any attention to the *vertical* divergence, or angle formed between the *upper* and *lower* sides of this pyramid, is rendered entirely unnecessary, by assuming that it produces the greatest possible effect it is capable of, in rendering the image visible to the very foot of the Light-house. It will therefore only remain to ascertain the *lateral* extent of these rays from each mirror, to obtain the number of the degrees of the horizon illuminated by the *reflected* light of the lamp from which they proceed, and within which its image will be visible; and by repeating this with each lamp and each mirror, ascertain the effect produced by the whole combined. Now, it has been before observed, that the divergence of the rays before and after reflection remains the same, and that the sides of a cone or pyramid of reflected light, have exactly the same mutual inclination, and comprehend the same angle after quitting the plane, which they subtended before reaching it. For instance, that if a be the lamp, (Fig. 12) and $a\,b$, $a\,c$ the limits of a pyramid of rays striking the surface of the

mirror *b c* and reflected from it in the directions *b d*, *c e*, that the angle *d h e* comprehended between the sides of the *reflected* pyramid *a b c e*, will be equal to the angle *b a c*.

In order, therefore, to ascertain the lateral extent embraced by each pyramid of reflected rays, it would answer the purpose just as well, if instead of projecting and taking the measurements of these rays themselves, we were to substitute for them the angles which each lamp forms with the two edges of each mirror, viz. if the angle *b a c*, shown in the annexed plan, be substituted for its equal *d h e*. As this is a much less troublesome operation, and as it renders the figure less complicated, I have accordingly done so; and the following are the measurements of these angles, for the three rows, taken separately, as shown in the accompanying plan, Fig. 13.

Table, showing the breadth of the angular spaces illuminated by the reflection of the light of each lamp from the different mirrors.

No. I Tier.

Of three lamps and 3 reflectors.

Lamp.	Reflector.	Angle.	Total.	
1	*a*	22		
,,		14½		
,,	*c*	12½	49	
2	*a*	19		
,,	*b*	19		
,,	*c*	19	57	
3	*a*	12½		
,,	*b*	14½		
,,	*c*	22	49	155°

In each table the *numbers* refer to the different *lamps* belonging to the tier, which are numbered from left to right as shown in the plan. The letters *a*, *b*, *c*, refer to the three reflectors, which are taken in the same order. "No. 1, *a*" consequently, refers to the rays proceeding from the *left hand* lamp, and reflected from the mirror nearest it on the same side.

From the above measurements it appears, that a reflected image of the centre lamp will be visible throughout 57 degrees of the circumference of the horizon, and of the other two in 49 degrees each.

Therefore, if the effects be *equally* distributed over the whole illuminated space, there would be visible from the *upper* row of lamps and

Fig. XIV.

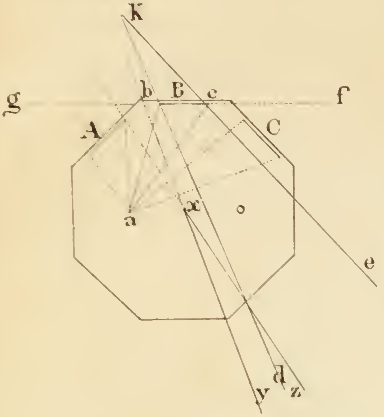


Fig. XV.

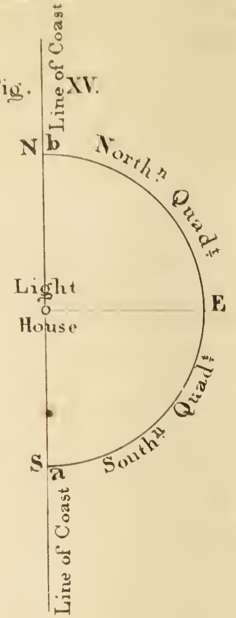
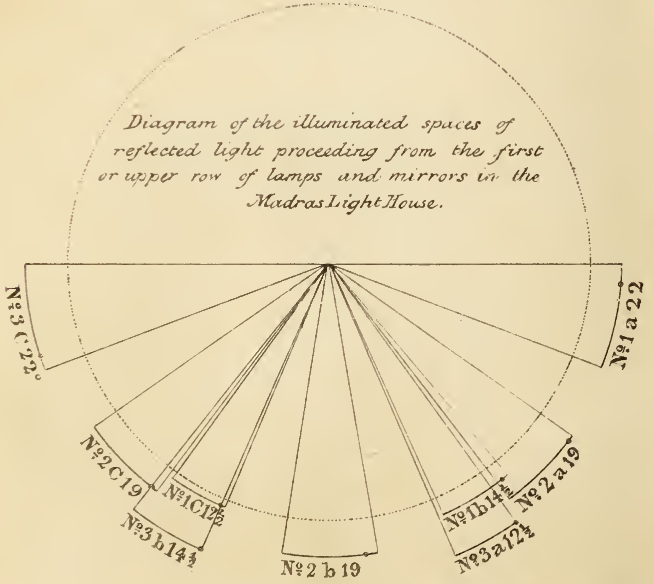


Fig. XVI.



material composing the mirror was speculum metal of highly brilliant lustre, and polished in the most exquisite manner, it would not be assigning too little to mirrors of looking-glass of the common description, to assume that they would only return 50 out of 100.000, or one half of the incident rays. In this case, what would be the value of the nine reflectors? In the most favourable situation it would appear that they would increase the brilliance of the 12 lamps so as to render them equal to *fourteen*, and in less favourable ones, that their assistance is not much superior to the addition of a *single* extra lamp.

I am aware, however, that this estimate has been made to rest upon an assumption, which may not, upon examination, be found to correspond with the actual circumstances of the case. It is indeed highly probable from the nature of the apparatus, that the duly regulated distribution, necessary to produce an exact equality of light may not be attainable, and that great irregularity in this respect may be found to exist. Admitting such however to be the case, the above would still be a correct measure of the *average* effect produced throughout the whole extent of the horizon, and a fair statement of the benefit derived from the apparatus, as it is evident, that if, owing to such inequality, it should be found that the effect produced in any particular point of the circumference were much in excess of what is above assigned, such a circumstance could only be occasioned, by a corresponding defect in some other quarter, which would fall short in an equal degree.

In order, however, to prevent this point remaining a subject of doubt, I have thought it worth while to lay down on paper, in the accompanying plans (Figs. 16, 17 and 18), the whole of the diverging rays, in the situations in which they are actually reflected, making the angles of incidence and reflection equal, in accordance with the law in optics before alluded to, so as to exhibit in one view the whole of the spaces in which the reflected images of every lamp, from the surface of each reflector are to be found.* The manner in which this has been done is represented in Fig. 14, where the positions of the rays *c e* and *b d*, have been ascertained

* It will be observed that in the 17th and 18th figures one angular space on each side is made to overlap, and in part to fall in rear of the line *g f* of Fig. 14, parallel to the surface of the central mirror, and it is evident that not only these, but also a small portion of the rays in front of them, towards A and C could not be visible, owing to their being intercepted by the opaque sides A and C. I have thought it better however to leave them in Figures 17, 18, and 19, in the places to which they would be *directed* by reflection, in order that each group of rays might be duly accounted for, but they have afterwards been deducted in summing up the effects and arranging them in a tabular form.

by marking off the angles *f b d* and *f c e* equal to their corresponding angles of incidence *a b g* and *a c g*.

The same having been done regarding the other two reflectors A and C, a similar operation was performed, and a similar set of angles obtained from the second or middle lamp, and afterwards from the third, until the whole set belonging to the first tier of lamps and reflectors was complete.

As the figure would have been very much confused from the intersection of so many diverging lines from different points, owing to the difficulty of referring them to their respective centres, and comparing their relative directions, I have in the diagrams representing the spaces illuminated by the three different tiers (Figures 16, 17, and 18), referred the whole to a common centre, an arrangement which greatly facilitates their comparison with one another, as it exhibits them combined under one view, at the same time that it does not in the least affect the truth of the representation, as the distances of the real points of divergence from the central point of the light room to which they are referred, is so small when compared with the distance of the circumference of the horizon on which the angular spaces are measured, that the effect produced by the change in position which such an arrangement requires, is in reality entirely imperceptible.

In order to render the operation here alluded to, still more easily understood, I have represented the manner of effecting it in the figure last given. The point to which all the cones of rays are referred is there represented by *x* – *b d* and *c e*, are the resulting lines of direction of the two rays *a b*, *a c* proceeding from the lamp *a* and reflected from the mirror B. The angle which they subtend with one another, and the general direction of the cone of rays, is at once obtained by producing them till they meet in K, and the angle which is substituted for it at the point *x* is found by drawing *x y* and *x z* parallel to *k d* and *k e*. In the three figures Nos. 16, 17 and 18, these angles have been laid down separately for each row of reflectors and lamps, as it has before been shown, that no reflected light is visible, from the lamps of one row and mirrors of another. In order to distinguish the different sectors of rays from one another, they have all been marked, both with the number of the lamp whence the light originates, and the particular reflector from which it is thrown, in the same manner as in the tables before given. For greater convenience in summing up the results also, the number of degrees comprehended by each group of rays is also marked upon the plan, and in Fig. 19, the whole of the preceding results are brought together at once, by combining the three Figures 16, 17 and 18, into one. In considering the

Fig. XVII.

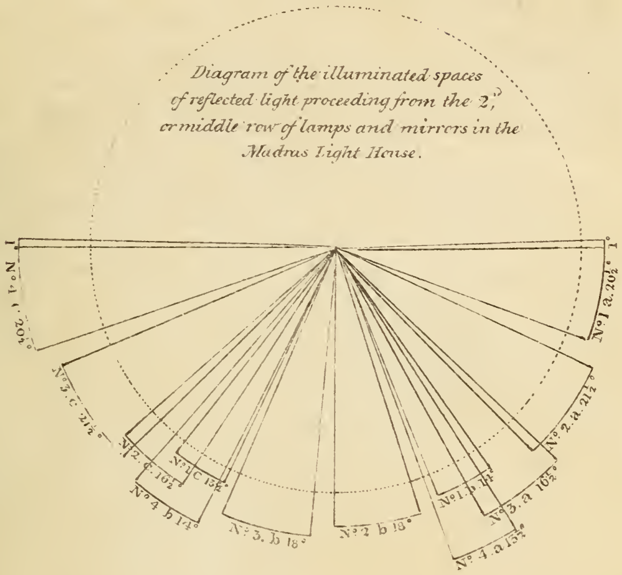
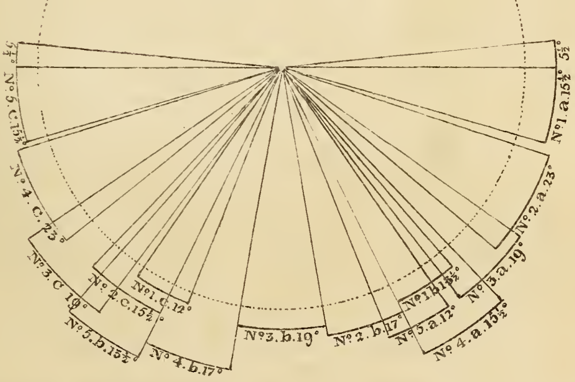


Fig. XVIII.



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result thus obtained, it should be carefully borne in mind, that each of the sectors laid down in the three figures, represents the angular portion of the horizon throughout which the reflected image of some *one* of the lamps is rendered visible, by means of *one* of the reflectors, and consequently, that when two or more of these angular spaces occupy the same part of the horizon, or overlap one another, two or more images will be seen, and so on.

The object of the arrangement adopted in the 19th figure, is, by exhibiting the whole of the reflected rays in one view, to point out, both where irregularity in the distribution of the light exists, and also the exact quantum of advantage derived from the reflectors in every separate portion of the horizon, as the number of reflected images visible in any particular point of it will of course be shown by the number of angular spaces of rays, within whose confines it may happen to be situated. With regard to the first point it will at once be seen from the figure, that very great inequality in the diffusion of the light prevails, the whole of the diverging beams appearing to be huddled together near two points equidistant from the centre of the semi-circumference*, while that part itself, and the portions near the diameter *a b* (in Fig. 15) are in comparison very scantily supplied.

As there is some difficulty, owing to the number of lines indispensable to the figure, in distinguishing the angular spaces from one another, and ascertaining the number which lie over any particular part, I have in Fig. 20 given another representation of the same semi-circumference, in which the differently illuminated parts are marked off, and distinguished from one another according to the number of reflected images visible within them, and, as the number of degrees of each of these spaces is marked on it, as well as the number of images visible throughout it; this figure contains within itself, a condensed view of the whole of the results exhibited in the other four diagrams.

I have also given a tabular form to the contents of the last diagram No. 20, in order to admit of a mean being found, and a comparison made, with the estimate of the *average* effect formerly taken. This has been obtained by multiplying the number of images visible in any part of the horizon, by the breadth of the space, expressed in degrees, throughout which that number is seen, and adding the whole of the products together, and dividing by the number of degrees contained in the entire semicircle; by this process, and after rejecting the first $5\frac{1}{2}$ degrees in each quadrant represented in Fig. 19, in consequence of their falling

* Measuring about 30° on each side, from the point E (of Fig. 15).

outside of the semi-circle, the sum of all the products is found to be $601\frac{1}{2}$, which divided by 180° gives 3.34 as representative of the *mean* value expressing the number of reflected images throughout the whole circumference, a result which corresponds, pretty nearly, with that formerly obtained which represented *less* than four and *more* than three images, and in nearly the same proportion, viz.

$$3 \text{ and } \frac{84}{180\text{ths}} \text{ or } 3\ \frac{21}{45\text{ths}} = 3.4 -$$

In the following table the different spaces have been marked down in the order in which they occur, on tracing the circumference from South to North, or from *a* to *b* in the annexed diagram No. 15.

TABLE

Of the breadths of the various portions of the horizon differently illuminated by the reflected light, with the number of images visible in each.

	Southern Quadrant. Breadth of the spaces illuminated.	Southern Quadrant. Number of images seen in them.	Northern Quadrant. Breadth of the spaces illuminated.	Northern Quadrant. Number of images seen in them.	
a	Degrees.. 16	3	Degrees... 2¼	2	*E*
	1½	2	7¼	3	
	3½	3	10¾	2	
	1	2	1¼	1	
	3½	1	0¼	3	
	10½	2	0¾	4	
	4	4	3½	6	
	4	3	3	7	
	3	4	4	8	
	1¼	3	1	7	
	2¼	4	0½	6	
	2¾	5	0½	5	
	1¾	4	1¾	4	
	0½	5	2¾	5	
	0½	6	2¼	4	
	1	7	1¼	3	
	4	8	3	4	
	3	7	4	3	
	3½	6	4	4	
	0¾	4	10½	2	
	0¼	3	3½	1	
	1¼	1	1	2	
	10¾	2	3½	3	
	7¼	3	1½	2	
E	2¼	2	16	3	*b*

Fig. XIX.

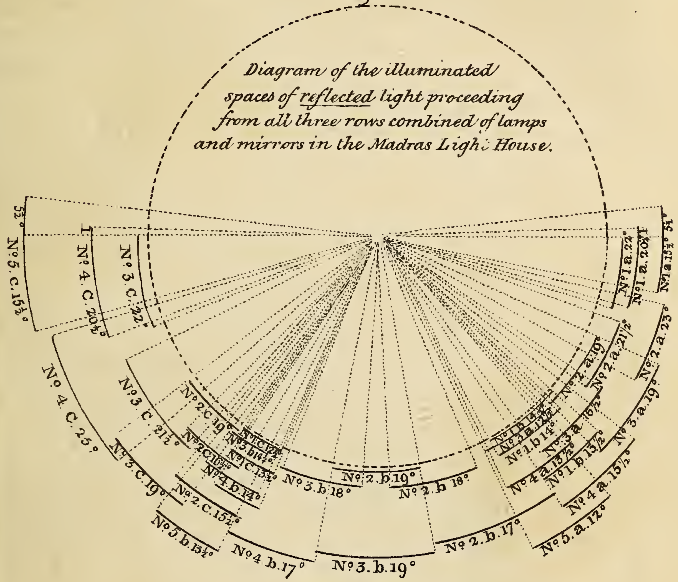
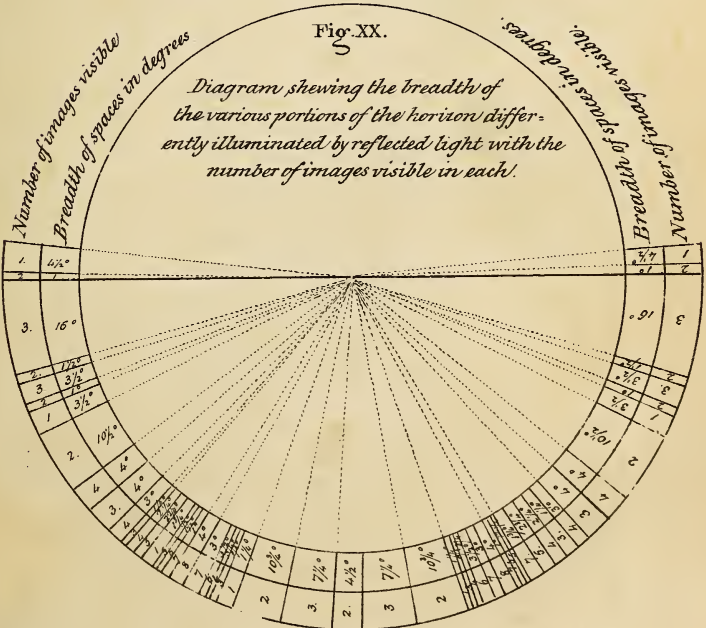


Fig. XX.



NATURAL HIST

By arranging the contents of this same table in another form, by adding together the spaces in which the effects produced an equal, it will appear that there are

Degrees		Images
9½	degrees in which only one image is visible	1
52	in which	2
64½	,,	3
23½		4
6½	,,	5
8	,,	6
8	,,	7
8	,,	8.

Or to condense it still more, that out of the whole semi-circumference of 180 degrees, the portion in which 1.2.3 and 4 images of a *single* light only are visible, amounts to 140°, or 7-9ths; the remaining 2-9ths being illuminated by 5.6.7 and 8. When it is recollected that, as before shown, the brightness of these images is only one *half* as vivid as that of the *direct* unassisted light, and when it is also considered, that the total value of this *direct* light is represented by 12 of these doubly powerful images, visible throughout the *whole* circumference of the horizon, it will no longer be a matter of surprise that the light in its present condition, although stated in the Almanac to be visible (by which I understand *possible* to be seen) at a distance of 27 miles from the mast-head of a large ship, is in matter of fact with difficulty discerned at 15 or even 10.

It might have been expected, that the very great difference above shown to exist in the value of the assistance afforded by the reflecting apparatus, as seen from different points, would have occasioned a material inequality in the brightness of the beam generally, as viewed from a distance in different directions; which, had it prevailed to any extent, could not fail to have attracted attention; and there is no doubt that such would have obtained, if the whole effect produced by reflection, bore any thing like a large proportion to the whole illuminating power. But it has been before shown, that in the situations where it is most powerful, and even within the very small limits in which 8 reflected images are seen, the actual increase of the refulgent power exclusively due to reflection has no more effect than would be derived from the addition of 4 extra lamps; or that the share of effect due to the assistance of the reflectors, is even then, only *one-fourth* of the whole brightness of the visible beam. It is therefore hardly to be expected, that a gradual increase or diminution of power which at its maximum does not exceed 1-4th, and whose *average*

barely exceeds 1-8th, should be capable of producing any very sensible alteration: which, even if it did take place, to a much greater extent than is here shown to be possible, would be entirely lost in the fitful and uncertain glimmering, which characterises the whole beam at great distances.

It has been my object, however, in what I have above written to demonstrate, not so much that the light must of necessity be defective, as that if it should happen to be so, abundant reasons might be shown to exist for anticipating such a circumstance, from causes which it has been my endeavour to point out. I leave the fact of its *being* so or not, to be established by the testimony of those who may be able to speak from experience, and will at present merely add, that if the opinion which I at the commencement of this paper ventured to express, regarding the extreme inefficiency of the contrivance as it exists at present, be granted to be correct, it would not be unreasonable to anticipate, that a considerable improvement in it might be effected, if the importance of the light were considredred sufficiently great, to warrant the expence of its being remodelled upon a more scientific plan, and which I feel satisfied might be done without any very alarming outlay. It was my intention to have appended to this some observations on the spherical and parabolic mirrors used in England for this purpose, in the hopes of attracting to the subject the attention of others more competent to examine it than myself; but I have already been carried to a length so far beyond what I originally intended, and the subject is one of so little interest to the general reader, that I cannot expect to be granted the indulgence of further occupying the pages of your valuable work, to the exclusion of more important matter, and I must therefore content myself with the hope, that should communications of this kind be suited to the character and objects of the "*Madras Journal of Literature and Science*," I may at some future period, have it in my power to make up for the deficiency.

I remain, &c.

J. T. S.

Madras, November 1833.

IV.—*On the Crystalline Structure of the Trap Dykes in the Sienite of Amboor: with an Enquiry into the Causes to which this Peculiarity of certain Igneous Rocks is due.—By* Richard Baird Smith, *Lieutenant, Madras Engineers.*

The phenomena exhibited by the internal structure of certain rocks, which a large class of facts clearly prove to have been, more or less, acted on by subterranean heat, have lately had the attention of observers specially directed to them; and a wish has been expressed by an eminent geologist,* that, since the study of these peculiarities has, as yet, received but little attention, it would be therefore desirable, that information should be collected relative to them, for the purpose of enabling us to enquire into the causes of their production. Having lately been enabled to examine the geology of the route from Madras to Bangalore, I was especially interested in the results of an examination of the trap dykes, in the sienite around the village of Amboor; and since in these the phenomena, above alluded to, were strikingly exhibited, I have ventured to throw together a few remarks deduced from these observations. Since the field is one of comparative novelty, perhaps interest may be excited, and the attention of those qualified to explore it, be directed more particularly towards collecting the information relative to it, so much desired.

The underlaying rock of the plain on which the village of Amboor is situated, is the sienite so universally met with throughout the range of the ghauts. This sienite outcrops at various points in the plain, and occasionally by its disintegration, gives rise to boulder-like masses, which are found scattered around in great abundance. Mingled with these, are weathered, and apparently water-worn, fragments of other rocks, as of granite, gneiss, &c. varieties of trap, compact, and vesicular felspar, quartz, and porphyries. The non-appearance of the parent rocks, from which these fragments have been derived, in the neighbourhood, or actually *in situ*, proves that some transporting agent has been acting upon them. This perhaps may have been the nullah which intersects the plain, and seems to take its rise among the distant hills, where, doubtless, the rocks above mentioned are largely to be met with, since all belong to the primary series. These may have formed the bed of the stream, and, thus being subject to continued abrasion, they would readily yield to any increased force the current might acquire, from the

* Mr. De la Beche—"How to Observe."

fall of rain, or other similar causes, masses would be detached, and borne along to distances according to their size and weight. They seemed all nearly of the same size, and of equal specific gravity, hence we may infer, a transporting power of equal intensity had acted on all, and hence, also, an additional argument might be derived for their being true boulders. On finding, however, that in one part of its course, the nullah was confined by an artificial bund, mainly composed of masses similar to those strewed over the plain, the possibility, that the latter might have been derived from the former, suggested itself, and naturally tended to throw doubts on the first idea, that the masses had been brought, by the force of the stream, from the distant hills; evidence is however, wanting to enable the inquirer to form any decided opinion, and, therefore, it is best to rest satisfied with a simple statement of facts, without attempting to draw conclusions, for which these cannot be deemed sufficient warrant.

The road to Palliconda intersects the range of hills which forms the enclosure to the plain of Amboor, at a distance of about half a mile from the latter place. At this point, the road winds along between two hills forming portions of the main range. To the left hand of one of these, my attention was particularly directed*, and on examina-

* At Palliconda, I examined with much interest the geological features of a large hill in its vicinity which I subsequently found had been described by Dr. Benza. On comparing my notes with his description I found there was no essential difference between them, save in one or two trifling instances, arising from the different degrees of attention with which we had examined different localities. I will annex therefore in this note only a rapid sketch of the results of my observations, referring those desirous of seeing the subject treated in greater detail to the paper above alluded to. The plain at the base of the hill is sandy, and strewed over it, there are masses of a sienite, which, as is proved by the natural sections exposed at various points in the beds of the neighbouring nullahs, forms the underlaying rock of the whole. Traversing this there are dykes of trap and porphyry, with veins of quartz and felspar. The two latter are sometimes found together—the quartz massive and the felspar crystalline, forming together a compound coming under the class porphyry. Since it is a general principle, recognised in naming different members of this class, to distinguish these by affixing the name of the matrix in which the crystals are imbedded to that of the general class, I have adopted the name of quartz porphyry for the above. It may be remarked in passing that it is of the greater importance to adhere to some general principles in the nomenclature of geology, as few sciences have suffered more from these having been lost sight of. The progress of our studies is most seriously impeded by the different arbitrary systems authors have employed, and the necessity for a table of synonyms is absolute when we wish to compare different works, each of which perhaps describes the same rock under names so different as to render their identification quite impossible. Investigating a portion of this quartz porphyry, I found a simple mineral to which I could not assign a name, never having seen it before. The characteristics of this are as follow—lustre highly metallic, inclining to adamantine—colour dark grey, nearly black—hardness between 7 and 8—fracture splintery—structure laminated—specific gravity not numerically determined, but high—crystalline

tion, I found it to be wholly composed of sienite, intersected by various trap dykes of different dimensions. These dykes maintained, throughout their whole extent, one uniform and parallel direction, being all at right angles to the line of the road intersecting the main range, and consequently parallel to the main range itself.

The trap, of which these dykes are composed, consists of a matrix of dark coloured granular hornblende, throughout which small grains of mica are interspersed.

On examining the trap at its lines of junction with the including sienite, decided marks of alteration are observable in the former, though not in the latter—the hornblende becoming of a much lighter colour, while the grains of mica become larger, and most distinctly developed. Traversing the dykes, and *invariably* at right angles to the cooling surfaces of the sienite, I found small cracks or fissures—a similar remark to this, has been made on the comparatively recent ejections from certain volcanoes, and more especially on those of mount Vesuvius, of which Mr. Lyell remarks—" There is a tendency in all Vesuvian dykes to divide into horizontal prisms, a phenomenon, in accordance with the

form—a flat rhomboidal prism, having an obtuse angle=about 130° and an acute angle-about 50°; the want of a goniometer put it out of my power to do more than approximate to the side of the angles of the rhomboid-cleavage, regular and single in a plane at right angles to the axis of the crystal. Exposed to the action of undiluted muriatic acid it deepened the colour of this to a dark and beautiful orange hue—to nitric acid it communicated a greenish tinge, while in sulphuric acid no action whatever took place. From the two first effects I was led to suspect the mineral to be one of the crystallized salts of iron, and under this impression I added to each of the acid solutions, ammonia and oxalic acid, expecting precipitation to follow. In this however I was disappointed ; no such effect being produced. The mineral strikingly resembles in external appearance the specular iron ore, but in comparison I found they differed in crystalline form, the latter being octahedral while the former as was before stated is rhomboidal.

On examining the main body of the hill I found it composed of sienite, intersected by numerous trap and porphyritic dykes—one of the latter I found capping the sienite, so as to seem at first sight to be an overlaying rock, but on further examination its true nature is easily detected and its limits observed. Much variety is observable in the composition of the dykes and veins. Sometimes the quartz of the porphyries disappears altogether, when we have pure felspar left. Sometimes hornblende predominates, and sometimes nothing but quartz is seen. The felspar was often of a pinkish hue, and generally so much decomposed on the surface as when pressed in the hand to crumble into dust—sometimes it became dendritic, the tree-like forms being due to small vesicular cavities, presenting a very beautiful appearance. In the vicinities of the nullahs abundance of water-worn masses of basalt, greenstone, claystone, &c. are met with, though as might be anticipated they are more sparingly distributed at a distance from these. For further particulars, see Dr. Benza's paper on the Geology of the route from Madras to the Hills, in No. XII of this Journal.

formation of vertical prisms in horizontal beds of lava, for in both cases, the divisions which give rise to the prismatic structure are at right angles to the cooling surfaces." Now in the trap of Amboor, I was especially interested by finding, that, independent of these fissures at right angles to the cooling surfaces, there were also distinct planes of cleavage, or as miners call them " joints," which when combined with the fissures, render the trap divisible into these very prismatic forms, spoken of by Mr. Lyell. I found it impossible to break the trap otherwise than into regular, and prismatic fragments; and this regularity of internal structure clearly proves, that crystallizing forces must have been in operation throughout the whole, to produce such striking results. The cleavage planes invariably exhibited an ochreous hue, as if a portion of the oxide of iron, which, in a greater or less proportion, ever forms a constituent of hornblende, had been decomposed, and determined towards these planes, by an action analogous to that, by which certain bodies are determined towards the different poles of a galvanic battery.

Additional interest is attached to the phenomena above described, when we learn they are members of a class which has been largely recognised throughout the natural world. The following remarks by Professor Sedgwick, will prove their existence throughout large districts of England and Wales. In both of these countries, the slate formation is of great extent, and speaking of certain parts of it, he had examined with much care, Professor Sedgwick remarks—" Besides the planes of cleavage, formerly spoken of, we often find in large slate quarries, one or more sets of cross joints, which, when combined with cleavage, divide the rock into rhomboidal solids. These solids are not capable of indefinite subdivision into similar solids, except in one direction, namely that of true cleavage, and in this way, we may, even in hand specimens, distinguish the true cleavage planes, from the joints." This, I found, was a matter of great ease in the trap of Amboor, for, independantly of the ochreous hue before mentioned, as characteristic of the cleavage planes, the joints or fissures being free from this, it was vain to attempt to fracture a mass, save in the direction of the sides of the prisms, while when the effort was made in this manner, division was easily accomplished. Speaking of the joints, Professor Sedgwick continues—"These last are fissures, placed at definite distances from each other, the masses of rock between them having, generally speaking, no tendency to cleave in a direction parallel to them." This remark is also applicable to the trap of Amboor, the direction of cleavage never being parallel, but invariably perpendicular, to that of the fissures. These last may be attributed to the mechanical action, produced on the rock, either during con-

traction, while the fused mass originally ejected from the interior of the earth in a fluid, or semifluid, was passing into a solid state, the tension thus caused, producing more or less regular sets of cracks, or fissures. It is impossible, however, to attribute to a like origin the phenomena of cleavage planes, they being distinctive of crystalline forces, and affording proofs, that the ultimate particles of the rock have been subjected to chemical action, whereby this peculiar arrangement has been effected.

In instituting the following enquiry into the causes to which these phenomena are due, the first step will be to collect as many analogous ones as possible, and thus to form a series of classes, whose relations to each other may be observed, and a clue thus obtained, by which the common cause operating on all, may be at length discovered as the leading member of this class, and the head under which the others are to be ranged may be placed.

(1). The phenomena of dykes, observed under different circumstances, both in the volcanic rocks of the present, and in those of past eras. By a fair and close induction from observed facts, geologists universally agree, that these rocks were originally ejected in a fluid, or viscous state, and have gradually assumed their present hard, and compact nature, as they parted with the temperature they then possessed.

(2). The slates of Cumberland and Wales, described by Prof. Sedgwick, the analogy between the peculiarities of whose structure, and those of the trap dykes, has already been noticed, belong to a class of rocks, to which Mr. Lyell has applied the term " metamorphic; " such rocks, this eminent geologist considers, to have a sedimentary origin, being originally deposited from water, but subsequent to their deposition, he conceives them to have been modified and acted on by internal heat. Whether that heat was sufficient to reduce them to the fluid state, so that polar forces might act with greater freedom, is, as will afterwards be proved, a question of little, or no importance, as bearing on the present enquiry. It is sufficient for this, that heat should have been in action at all, its intensity being of comparatively little consequence.

(3). Intimately connected with the two preceding classes, are the phenomena exhibited by altered rocks, or those in the immediate vicinity of decidedly volcanic products. These rocks are sometimes in actual contact with the originally fused masses, as when they form the walls of a dyke, and then at the planes of junction on both sides and to some distance beyond them, phenomena analogous to the preceding are

most commonly met with—Chalk in the vicinity of basalt, is known to become beautifully crystalline: the crystallization being most perfect, in the immediate neighbourhood of the altering rock, while it becomes gradually less and less distinct as we recede from this. Numberless instances similar, and even more striking, than the above might be adduced, the facts however are so familiar to every geologist, that I do not consider it necessary to advance more; in all, however, this is observed, that crystals only appear in those localities, affected by the dyke. The sienite, including the trap dykes of Amboor, exhibited no signs of alteration; but this is by no means an uncommon circumstance, and it finds a ready explanation, when we bear in mind, that the original temperature of injected rocks may vary considerably, and also that the conducting powers of different rocks, on which their susceptibility of alteration materially depends, are also very variable; from these two causes, it may frequently happen, that certain rocks exhibit no signs of alteration, under circumstances apparently similar to those of others, in which these signs are strikingly apparent.*

The three preceding classes belong peculiarly to the province of the geologist, all being taken from his particular science. Now in this, it most frequently happens, that effects only remain to us, the causes to which these are due having ceased to act; it therefore becomes necessary to advance with caution, in our enquiry as to what these causes may have been, and rigidly to examine and verify each step we take. Hence, then, it is very natural for us to enquire, if there is a possibility of producing effects analogous to those observed in the natural world, while we can watch also the cause in operation to produce them. This remark leads us to the consideration of a fourth class, by which some additional light is thrown on the enquiry.

(4). In this class, I purpose including the results of the researches of several eminent chemists, on the production of crystals, similar to those occurring in nature, through the agency of heat, of greater or less intensity. Among these, Mitscherlich of Berlin has been the most successful, and to him we are indebted for a large proportion of the new and interesting information these researches have furnished. Having by careful analysis, made himself acquainted with the proportions, existing between the component parts of different minerals, he formed a mixture, in which these were retained, and after exposing this to the

* On examining the sienite of Waniamboddy in which trap dykes are also abundantly met with, I was equally unsuccessful in my search after signs of alteration. Benza however mentions having met with them occasionally. In Antrim, Isle of Anglesea, &c. these alterations are remarkable.

action of a furnace till fusion took place, when it was removed, and allowed to cool, he thus obtained, synthetically, those very minerals, in a state quite analogous to that in which they had been found in the natural world. Having in this manner combined the elements of mica,* he succeeded in forming beautiful, and distinct crystals from them, in this case, finding it essential, that the fused mass should cool very slowly. This remark is very interesting as connected with the formation of sienite, granite, &c. in which mica occurs so abundantly. Similarly, having combined the elements of augite†, he succeeded in obtaining it in a crystalline form, more rapid cooling being requisite for it than for mica. This also is quite consistent with the observations of mineralogists, who remark that augite is always found associated with such rocks, as have experienced a rapid decrease of temperature. So material is the influence exerted by rapid cooling, on the nature of certain minerals, and especially on augite, that it is often the only cause of their differing from certain others. Thus in reference to augite, its composition, and many of its external characters, are precisely similar to those of hornblende, so much so, that Professor Rose of Berlin has proposed, to consider them as one and the same mineral.

Since hornblende enters so largely into the composition of all trap rocks, and especially abounds in the trap of Amboor, the following remarks, relative to the cause of the difference between it and augite, are very interesting :—" It is well known," says Allen, from whose useful work on mineralogy I quote "that augite and hornblende seldom occur together: and that when they do, it is in trachytic rocks and lavas of later date, in which the one forms crystals in the cavities, the latter, a portion of the mass. The frequency of augitic forms, and the non-occurrence of hornblende, among crystalline slags—the results of Mitscherlich and Bertheor's experiments in producing augite artificially, whereas they never succeeded in forming hornblende, and lastly, the general occurrence of hornblende, associated with quartz, felspar, &c., and such rocks as have experienced a slow decrease of temperature, while augite is always associated with others as olivine which are known to have cooled rapidly—all concurred, in leading Rose to conclude, that the crystalline form presented by each of these substances, depended entirely on the more or less rapid cooling to which they had been exposed. Upon fusing in consequence, a mass of hornblende in a porcelain furnace, he found that it did not in cooling, assume its previous shape, but invariably took that of augite." Such being the

* Buckland's Bridgewater Treatise.

† do. do. do.

case, Rose concluded they ought to be looked upon as the same, and included in one class; of the propriety of which step, the preceding remarks seem to leave but little doubt. These experiments are most interesting, when viewed as furnishing us with a standard of comparison, by which we may form some idea, of the different times required for the production of different minerals in nature. The rate of cooling may also be estimated, from the peculiar forms assumed by the minerals produced, as for instance, in the sienite, so frequently mentioned in this paper, the ingredients of which, the quartz, felspar, and hornblende, are all known to require slow cooling for their production; and, therefore, we conclude the sienite to have passed very gradually, from its highest point of temperature, down to its present state—similarly, with reference to the trap dykes under consideration, in which hornblende and mica prevail, substances also requiring slow and gradual cooling for their production. The earliest experiments on record, by which the connection between the crystalline structure, and the application of heat was exhibited, are those of Sir James Hall, in 1798: in 1801, Mr. Walt pursued the same subject in greater detail, while in our own day, Wollastone, Millen, and Haidenger, have been occupied in the same train of research. I do not intend to enter farther on this point, since enough has been adduced to prove the analogy subsisting between these operations of men in their laboratories, and those due to the action of the general laws by which God governs the material world, and which are included in the three first classes.

Now, the general and connecting link of the whole series of phenomena above described, is their dependance on the application of temperature, but, it will readily be observed, it is not so much on the absolute degree of this, to which the substances exhibiting them have been subjected, that the phenomena depend, as upon the fact, that the original temperature has undergone variations of greater, or less, extent. Had the original heat applied, remained the same, only the effects due to this would have been exhibited; as, for instance, if the heat had continued at the points of fusion, or of viscidity, the bodies, of course, would ever have remained in a fluid or viscous state: but, the gradual diminution of the temperature has given rise to new, and striking phenomena, dependant on it for their development, and following it invariably, as effects follow their cause. Assuming then for the present, that, as a natural law, including a certain series of phenomena, provided disturbing causes are not in operation, " signs of crystallization will follow on a body, kept in a fluid or partially fluid state by the action of heat, again becoming solid," it is natural for us to enquire if the law can be extended further, and be rendered more general in its expression, and application. And

first to show that neither fluidity, nor viscidity, are necessary for crystallization, I proceed to the consideration of certain facts included in class—

(5). In the collection of a friend, I had an opportunity of examining a fragment of sandstone, which had originally formed part of the floor of a baker's oven. On breaking up the floor for the purpose of repairing it, the whole of the lower portion of the sandstone was found most regularly, and beautifully crystallized, in prismatic columns of 6 or 8 sides, being the very forms so frequently assumed by basalt, and certain other rocks of igneous origin, and exhibited, on a gigantic scale, at the Isle of Staffa and the Giant's Causeway. The sandstone was I think about 2 or $2\frac{1}{2}$ inches thick, while the columns extended from a thin layer at the upper surface, of about $\frac{1}{3}$ of an inch in thickness, down throughout the remaining thickness of the mass. Looking at the exposed surface which formed the floor of the oven, no signs of the column beneath could be detected, and only when a fracture was made were they discovered. The sandstone was taken from a quarry, the rock of which was a member of the coal series ; its texture was close, and granular, and its general appearance proved, that though the heat to which it had been subjected, was sufficient to produce crystallization, it had not in the slightest degree, caused it to fuse. In farther illustration of this point, it may be stated, that Professor Mitscherlich found, on exposing prismatic crystals of sulphate of nickel,* in a close vessel, to no stronger heat than that of the sun, that, though externally unchanged, yet, on being broken up, were wholly composed of octahedrons ; while the same cause, changed, in a few seconds, prismatic crystals of zinc, also, into octahedrons. Crystals of sulphate of magnesia and of sulphate of zinc when boiled in alcohol gradually lose their transparency, and on being opened are found to be composed, internally, of numberless minute crystals, totally different in form from the originals. Most striking, indeed, are the views such facts give us of the state of the matter by which we are surrounded ; all seems in relative motion, and substances which to our senses seem as hard as adamant may, and indeed, judging from the preceding facts, actually are in a state of continued and increasing motion—who can say, but that the interior even of the diamond, excited by no greater cause than the warmth of the hand that wears it, would, were its particles and the effects produced upon them equally appreciable by our senses, exhibit a scene of as much turmoil, and change, as that produced by a

* Mrs. Somerville's Connection of the Sciences.

furnace, on the metal-filled cauldrons of an iron foundary, or on the water in the boilers of a steam-engine.

The further we advance, in our knowledge of the wonders of creation, the more reason do we find to adore the infinite power of that great, and glorious Being, to whom all is due: a power, of which we may form some slight idea, from the toil and labour required on our parts, to investigate those laws by which it works, when applied to the government of the natural world. Little cause is there for intellectual pride, when we reflect that the profoundest investigations, and the most refined systems of analysis adopted by mathematicians, the most extensive observations of the natural philosopher, reaching almost literally from pole to pole, or the most laborious researches of the chemist, all and each, are only, as it were, so many lines by which we are enabled to sound the depths of the power and wisdom of that God, who, by the simple expression of his will, called all those laws, as well as the matter on which they operate, into existence. The progress of discovery proves to us how little we *have* known of those depths; and gives to the following remarks of one, who, perhaps, if any human being could be entitled to glory in his intellect, to him the right would be conceded, a beauty and force, which make it one of the most striking on record.—" I deem myself," says Sir Isac Newton, to whom I refer, " to be like a little child playing on the sea shore—the waves every now and then washing to my feet a smoother or a prettier pebble, while the great ocean of truth is unexplored before me."—I now return to the consideration of the classes which still remain.

(6) Since my attention was directed to collecting facts for this enquiry, I have been much interested by observing the regular forms, into which the fine mud, forming the bottoms of tanks and pools, divides itself, after the evaporation of the surface water. Whenever the surface of the mud is exposed to the heat of the sun, the outlines of the figures begin to develope themselves, and as the evaporation of the water combined with the mud proceeds, these outlines gradually become more and more distinct, till at length complete separation takes place, and the whole mass becomes divided into columnar prisms, of various sizes, and bounded by different regular figures—sometimes the bases are triangular, sometimes quadrangular, but the most generally prevalent forms are pentagons and hexagons. Both the sides and angles of the different prisms vary in these dimensions, as indeed might be expected when we consider how much the affinity of crystallization must be limited by the nature of the mud, and also by local circumstances, some portion being more freely exposed to the action of

the sun's heat than others, and the state of division in which the particles are, being also variable.

In the ditch of the fort at Bangalore, I found the general depth of the prisms to be about 4 or 5 inches ; in one place however this was increased to as much as 8. Sometimes the lines bounding the figures are slightly curved, but these are exceptions to the general rule. In spite of the irregularity which modifying causes have produced on these forms, it is impossible to conceive they are due to simple mechanical contraction alone, and I cannot convey the view I am induced to take of their origin better, than in the language employed by Professor Sedgwick, relative to the analogous phenomena of the Welsh and Cumbrian slates. "We may safely affirm" says this eminent geologist "that no contraction of dimensions, no retreat of parts in passing from a fluid to a solid state, can explain such phenomena as these. They appear to me only resolvable, on the supposition, that crystalline or polar forces acted on the whole mass simultaneously, in given directions, and with a definite power." Similar appearances to the above are to be observed in the hard sun-dried soil so abundant in the neighbourhood of the cantonment of Bangalore ; also traces are to be noticed in chunam which has dried rapidly, on being exposed much to the heat of the sun, combined with the occasional presence of moisture. There are certain peculiarities connected with this class, which, however, must be deferred, till the general enquiry is more advanced—and therefore I proceed to the consideration of the last of our series.

(7) This class will include certain phenomena which have been exhibited by ice during a thaw, and which are strikingly analogous to the preceding classes, thus extending the law of the connection of crystalline form with variation of temperature, to an extent which scarcely could have been anticipated. The phenomena referred to, are described by Col. Jackson in the Journal of the Geographical Society : Mr. Lyell, to whose work I am indebted for the account of them, quotes it to show, that the phenomena are analogous to those of certain igneous rocks, but he offers no explanation, and indeed says "this tendency to a jointed structure is by no means understood : but it appears, from recent observations, that ice sometimes presents a similar arrangement of parts. Scoresby,* indeed, had long ago, when speaking of the icebergs of Spitzbergen, stated "that they are full of rents, extending perpendicularly downwards, and dividing them into innumerable columns." Colonel Jackson has lately investigated the subject with more attention, and has found that the ice

* Arctic Voyages.

on the Neva at St. Petersburgh, at the beginning of a thaw, when two feet in thickness,is traversed by rows of minute air bubbles extending in straight lines, sometimes a little inflected, from the upper surface of the ice,towards the lower: at from two to five inches of which they terminate." Other blocks presented these bubbles united, so as to form cylindrical canals a little thicker than a horse hair.—Observing still further, he says, "I found blocks, in which the process was more advanced, and two, three or more clefts struck off, in different directions, from the vertical veins, so that a section perpendicular to the veins would represent in miniature the star-formed cracks of timber. Finally, in some pieces these cracks united from top to bottom of the veins, separating the whole mass into vertical prisms, having a greater or less number of sides. In this state a slight shock was sufficient to detach them: and the block, with its scattered fragments, was in all respects, the exact miniature resemblance in crystal, of a Giant's Causeway. The surface was like a tesselated pavement, and the columns rose close, adhering, and parallel, from the compact mass, of a few inches, at the lower surface—more or less time is required for the process, which I have seen in all its different stages." This, as well as the preceding class confirm a remark previously made, namely that the phenomena in question depended essentially on variation of temperature, and it matters not whether this variation is caused, by the bodies losing, or gaining heat, as may readily be observed by comparing the circumstance of the different classes with each other. In the last case, the phenomena are first observed when a thaw commences, and their development keeps pace with the progress of this, so that their connection with the variation of temperature, during the passage of the solid ice into water, is thus evidently seen. In the former classes the variation was consequent on the passage of fluids into solids, and was therefore dependant on the obstruction of heat—in this it is exactly *vice versâ.*

Having, in the preceding seven classes, included all the phenomena analogous to those of the trap dykes of Amboor, with which I am acquainted, it now becomes necessary to consider with more care, and in greater detail, the mutual connection that subsists between them all—so that, if it be possible, we may by this means be led to some more definite ideas of the cause to which they are due, than we can now have.

Varied as the circumstances of the different cases have been, attention has occasionally been directed to that one point, in which all, without exception, have been found to agree. Now, it is a rule in enquiries of a

nature like the present, if we find that "in our group of facts there is any one circumstance in which they all without exception agree, that circumstance *may* be the cause in question, or at least a collateral effect of the same cause, if there be but *one* such point of agreement, this possibility becomes a certainty, and if on the other hand, there are more than one, they may be concurrent causes*."

Looking then to the group here assembled, we find that their subjection to a variation of temperature is the single point, in which they all agree; this, therefore, according to the above rule, given by Sir John Herschel, must be, either the cause itself, or intimately connected with the cause. We now proceed to examine this point, and in order that the results may be more clearly exhibited, one instance will be taken, and the various circumstances connected with it examined and discussed. Selecting, then, for this purpose, the trap dykes—we know, from generally acknowledged geological theories, that the trap of which they are formed, was originally ejected from the interior of the earth, at a temperature so high as to be kept by it in a state of fluidity similar to that of the lava currents of existing volcanoes. Let us therefore suppose we have before us a formation of this kind, an intensely heated and fused mass, included between two walls formed by the fissured rock. From the action of that law, by which bodies tend to an equalization of temperature, the moment contact was made between the heated trap and its including rock, an abstraction of caloric from the former by the latter would take place, and as the heat travels slowly from particle to particle of the including rock, to distances dependant on its conducting power, a continual demand is made on the trap, so that we may conceive two currents to be established flowing from each side of the dyke through the adjoining rock forming its walls. Now it is a singular fact, and one by which this enquiry is most materially advanced, that, under circumstances precisely similar to those under which the trap is here described as being, a combination is formed, by which large quantities of electricity are developed, and this development seems to be an effect of the variation of temperature. Hence, then, the idea that the cause we are in search of is this variation, becomes merged into the more definite one—that electricity in the active and operative agent, to which we are to attribute the phenomena whose production we are investigating. In electricity we have all the essential requisites for a cause by which natural phenomena may be explained, we know of its existence, of its be-

* Sir J. Herschel's Discourse on Natural Philosophy.

ing what Newton calls a "vera causa,"* we have examples of the effects it produces as an agent in natural operations; we may therefore safely reason about its efficiency in this case, and if we are supported by strong analogies derived from its "modus operandi" in other instances, we may be allowed to infer its being the active agent in this, since, to use the words of one† well qualified to judge, "we are not to deny the existence of a cause, in favour of which we have the unanimous agreement of strong analogies, though in the particular case it may not be apparent how the cause produces its effects."

These remarks naturally lead us to the more detailed examination of the cause, to which, from a discussion of the assembled group of phenomena and the application of special rules to these, we have been led—and first, we may establish the fact of its existence under circumstances like those of trap dykes, to which we still adhere as the representative of the others. The discovery that electricity might be excited by the partial application of heat to a circuit, into which no fluid entered as an elementary part, was made as early as 1822, by Professor Sæbeech of Berlin.‡ He employed a single bar of antimony, and having wound round the two extremities of this several coils of brass wire forming the poles, he applied the heat of a spirit lamp to one end of the bar—immediately a current of electricity was established, of intensity sufficient to affect most sensibly the needle of a galvanometer, placed under the circuit. This discovery of what has been called thermo-electricity (from the cause of its development) excited much interest, and the subject was pursued with great zeal, so that the thermo-electric relations of numerous substances were determined—all that seemed essential to the exhibition of these, was, that one part of the circuit should have a higher temperature than the other—the immediate consequence of which was, the determination of an electric current in a direction from the hot part towards the cold. There is no necessity for the substances employed being metallic, for M. Nobili§, a Florentine philosopher, has lately produced electric currents, by the contact of two pieces of moist clay, one

* Professor Whewell in his "History of the Inductive Sciences" questions the right of electricity to be considered a "vera causa," on the ground of its not being a physical reality, but due to the vibrations of an etherial medium. I use the expression without any special reference to the nature of electricity, of which we know so little, but simply as a means of conveying the desired expression as to the propriety of reasoning concerning its operations in the natural world.

† Sir J. Herschel.

‡ Dr. Roget's Treatise on Electro-Magnetism.

§ Mrs. Somerville's Connection of the Sciences.

of which was hotter than the other. I cannot pass by this curious experiment, without attracting attention to the interesting bearing it has upon the phenomena of the clay and mud, previously described under class 6. The circumstances of each are exactly similar, for, it will be remembered, the phenomena I described followed the evaporation of the water mixed with the clay, and it is most natural to suppose, that the sun's heat would not operate on every part with the same degree of intensity; hence then we have the exact arrangement of Nobili's experiment viz. moist clay, of variable temperature, in contact throughout. We may therefore conclude, that electric currents would traverse it. Further on this point, it is known, that evaporation is itself one of our most fruitful sources of electricity, and if the water evaporated holds any substance, either earthy or saline, in solution, the quantity of this is proportionally greater; the currents circulating through the clay would thus be increased in quantity, though their intensity would be small: but, as will be afterwards proved, this is the state best adapted for producing those effects attributed to them in this paper.

To prove further that it is a matter of indifference whether the circuit gains or loses heat, provided only that variation takes place, I may give a hasty sketch of some observations made on this subject* by Oeisted, the celebrated discoverer of electro-magnetism. He made a hexagon, the alternate sides of which were antimony and bismuth, the two metals whose junction gives rise to the strongest currents. First he heated one of the soldered angles, and immediately the galvanometer needle was deflected, when two alternate angles being heated the deflection became greater; and greater still, when the spirit lamp was applied to three. Changing his plan, he reduced the temperature of one angle by means of ice (doing which was vertically raising the opposite) and, as might be anticipated, the needle was again most sensibly affected. On applying temperature to these alternate angles, and ice to the intermediate ones, Oeisted obtained the greatest effect from the currents—thus shewing that the intensity depended on the difference between the respective temperatures of the elements of the circuit. Mr. Becqueral arrived at a similar result, finding that the intensity increased with the heat, though a limit seemed ultimately to be put to the law, varying in different substances. To shew that the electricity derived from the above sources is identical both with that from the machine, and the galvanic pile, I may mention, that one Italian philosopher has succeeded in decomposing

* Dr. Roget's Treatise on Electricity.—Society Useful Knowledge.

water and several solutions by its means, while another has produced from it a clear and distinct spark.

Sufficient has now, I trust, been said, to establish satisfactorily the development of electricity under circumstances analogous to those of trap dykes. In the latter there is every essential for such an effect, the original high temperature of the injected trap, the consequent abstraction of its heat by the including rock, in which the temperature was much lower, are in themselves the elements of thermo-electric currents, and a remark due in common with many others of a like nature, to Dr. Faraday, "that when a solid which is not a metal becomes fluid it almost entirely loses its power of conducting heat, while it acquires a capacity for conducting electricity in a high degree," proves to us how favourable their original state was, for being traversed by currents thus excited. Indeed from views which have thus gradually, and step by step, developed themselves during the progress of this enquiry, I cannot but look on trap dykes as being essentially electrical machines, developing continued currents of electric energy during the time that their temperature remains above that of the including rocks—these currents, following the law of intensity formerly announced, being proportional to the difference of temperature between the elements of the circuit. Viewed in this light, trap dykes contain within themselves both the agent, and the substance acted upon, the electricity developed during the process of refrigeration being the one, the constituents of the mass the other. The preceding form another of those many links by which heat and electricity are connected, and though confessedly this bond yet remains enwrapped in mystery, the time seems not far distant when greater light will be thrown upon it, as analogies are becoming stronger and stronger, and materials for the discovery, we might almost say, of their identity are rapidly accumulating. It would be quite foreign to our subject to digress on this point, I would therefore now offer a few remarks on the efficiency of the cause to produce the effects I have attributed to it, and enquire into the connection subsisting between electricity and the phenomena of crystallization; our enquiry must here be exclusively analogical, for it is only thus we are permitted to conduct investigations like the present, where effects remain after the cause to which they are due has ceased to operate.

Electricity, as known in the natural world, may be considered as of five kinds, to which the names, common, voltaic, magnetic, thermo and animal electricities have respectively been given; now one of the triumphs of modern science has been to establish, beyond a doubt, the identity of these varieties, by clear and distinct proofs. Similar effects have been produced by all; composition and decomposition, deflection

of the needle, and the obtaining of sparks, are the chief links of that chain which binds them to one common source. The last to which this has been extended is the animal electricity, or that derived from those animals, as the torpedo, to which God has given the power of administering shocks, as their weapons of defence. Professor Linari of Sienna has obtained both the direct and the induced spark from the torpedo, and Dr. Davy has decomposed water by its means. "It has been further proved, that the apparent differences are due to the peculiar state in which the electricity respectively exists, with relation both to its quantity and its intensity." Now, according to Dr. Roget, these states are three in number, first the state of highest tension, or that in which electricity derived from the common machine exists, when it accumulates till its force is sufficient to enable it to make its way through the air, which is nearly a perfect non-conductor. Second, in a similar degree of tension as when derived from the galvanic battery, where the path is more open to it, and therefore it does not accumulate so much as in the common battery. The metallic parts of the galvanic battery are good conductors, but the fluid ones are not so easily traversed, the quantity circulating is therefore greater, though its intensity is smaller than in the preceding case. Third, in the smallest of all degrees of tension, as in thermo-electric currents, throughout the whole of which no impediment to the free passage of the electricity is met with, the circulation taking place, as it were, from particle to particle, without any non-conducting medium being interposed as in the two first cases. The peculiarity therefore of thermo-electric currents is, that while their intensity is next to nothing, the quantity is comparatively very great. Now it will be considered as a striking fact in connection with this enquiry, when it is known, that batteries whose principles of action are the closest possible to those of thermo-electric circuits, have been extensively used as the means of producing crystillization in a very great number of bodies. Those singular experiments due to Mr. Crosse, and which, from the sensation they excited, are still doubtless fresh in the memories of all, were performed under the circumstances above referred to. Feeble currents, derived from batteries excited by no stronger agent than pure water, but continued for a long time, were the means in operation by which crystals of quartz, arragonite, carbonate of lead, lime and copper, &c. were produced. These experiments I partially repeated some time after their announcement with most satisfactory results. I employed more powerful batteries, and obtained crystals more rapidly, but these are never so perfect as when formed by long continued action. Mr. Becqueral, who has with much success pursued this new path, found that years

were required for the production of some crystals. I believe this philosopher has been the means of forming a Company at Paris, for the purpose of obtaining certain precious stones by the above means, in which I am told by a gentleman who saw them, they have so completely succeeded, that the rubies of the Company could not be distinguished from those of the jeweller. Now I cannot but consider it as strikingly confirmative of the view I am inclined to take of the cause to which the crystalline structure of the trap dykes, &c. is due, that the electric action in them is so precisely similar to that in the above cases. It is even more favourable in the dyke, for the circulation of the currents is more free, especially at first; of course as solidification progresses this is diminished, but this process goes on very slowly, as is proved by lava currents retaining their heat for such immense lengths of time, when the upper surface becomes solid, so as to oppose the further abstraction of heat.

It is further interesting to learn that already have electric currents been detected in metalliferous veins, as by Mr. Fox in those of the Cornwall mines; and though the electricity generated seems more due to chemical actions between different materials in the vein, than to any variations of temperature, still we know the identity of the two kinds, and therefore if one produces a certain series of effects, it is natural to conclude the other would do so likewise. Of Mr. Fox's experiments by which he was led to the above discovery, Professor Wheatstone remarks " the value of these interesting researches consists, in the exact analogy they bear to what actually takes place in mineral veins;" and the result proved how true this remark was. The details of these experiments are now before me, but I do not consider it necessary to enter into further detail on this point, as I trust analogies sufficiently powerful and numerous, have now been brought forward to demonstrate the efficiency of thermo-electricity to produce the phenomena as observed in the structure of trap, and also in other rocks placed under analogous circumstances.

This principle of explanation will readily be applied to all the classes forming the ground work of this enquiry, which here might fairly be brought to a conclusion, since of the peculiar manner in which electricity acts in producing crystallization, little or nothing is known. That it does do so we have seen, and beyond this all is comparative uncertainty; it is therefore with most unaffected diffidence that I venture to offer a few remarks grounded on what is known on this subject, as I can scarcely deem my enquiry complete till such an addition has been made to it. I feel my incompetency to do any thing like proper justice to this question, yet as some interesting information, though small in quantity,

has been collected, I will conclude this paper with a few observations deduced from it.

Crystallization being an arrangement of the ultimate particles or atoms of the crystallized body, according to certain definite laws, it is thence evident that these atoms are of determinate bulk, and that matter cannot in consequence be regarded as infinitely divisible, but must ultimately arrive at a limit. What this limit is we know not, but when it is attained, the atoms have also determinate figures, as well as bulk; for it is known, that certain crystals can only be built up complete by the continued addition of those elements whose form is fixed. Magnitude and form necessarily imply density, and it is known that the particles of a body, however dense that may be, are not in actual contact, but are separated from each other by indefinitely small spaces. Now, considering electricity as a fluid of the highest state of elasticity, M. Mosotti of Corfu conceives, that these minute spaces are filled with the electric fluid, so that each particle is confined within an atmosphere composed of it. Further, and as consistent with the general phenomena of electricity, he conceives that the atoms of the fluid repel each other; the molecules of the matter also repel each other; while there is a mutual attraction between the particles of the fluid and of the matter. Few indeed could follow the refined and elaborate analysis by which M. Mosotti has succeeded in adjusting these forces, but we can all understand and follow the conclusions at which he has arrived. He has proved that *within* certain limits the particles of bodies repel each other, the force of repulsion diminishing rapidly as the distance increases—*beyond* a certain limit the force becomes attractive, and hence there must be some point at which equilibrium between these two forces exists, and there is then no tendency either to repulsion or attraction; if therefore we attempt compression, the repulsive force resists, if we attempt disruption, the attractive force or the force of cohesion then comes into play. The limit at which the negative force becomes positive varies according to temperature, and to the nature of the molecules, and determines whether the body is to be solid, fluid or aeriform. Beyond the neutral point, the attractive force increases till it attains a maximum, and then diminishes, till as soon as the particles are separated by sensible distances it varies directly as the mass, and inversely as the squares of the distances—the well known law of universal gravitation.

Such are the results of M. Mosotti's profound investigations:—applying them, therefore, to the case before us, viz. crystallization, it is evident, that the form of the ultimate particles would materially influence the direction of the attractive and repulsive forces, and hence arises our con-

ception of the polarity of matter, an instance of which in a great scale, is given in the case of the magnetic needle, the polarity of which is now considered due to its electrical condition. Now the phenomena of crystallization entitle us to infer, that there is something like a definite polarity in every particle, by which it is compelled to turn in a given direction, and to group itself with other particles in definite forms—the polarity in the "glaring instance" is due to electricity—may we not reasonably, from the above remarks, infer the same cause, to produce a like effect, in an instance, less under the immediate cognizance of our senses.

By reference to some observations I made about a year ago,* I find a remarkable illustration of the above opinions, noted as having occurred during the crystallization of fused sulphur. On the vessel, in which the sulphur was melted, being removed from the furnace, and allowed to cool, the upper surface of the mass became covered with thin needle shaped crystals, about one-eighth of an inch in length, and about the thickness of hairs. To these crystals, it seemed as if a power of spontaneous motion had been communicated, since they flew about in all directions, first from one side of the vessel to the other, then back again, then across, and indeed they kept unceasingly on the move. On close examination, I found all the phenomena of polarity exhibited by these small bodies toward each other, and on watching two, I observed them gradually approaching each other, till they almost seemed in contact, then, suddenly, both started back from each other to some distance. Turning round they approached each other again, apparently with those sides turned towards each other, which admitted of the attractive force coming into play, for they would rush together, and form what then seemed to be but one crystal. This process was going on throughout the whole, and this alternate advancing and retreating was the cause of the incessant motion. The forms of the acicular crystals were quite different from those resulting from their continued aggregation, the one being long and thin, the other, bright prisms of nearly equal length and breadth, and from one-quarter to half an inch in thickness. This remark is quite agreeable to the researches of crystallographers, who have found that such thin crystals following certain rules of superposition and ranged in a certain order, produce others of entirely different forms.

I will not enter further upon this point, but I trust the few remarks I have made will not be altogether devoid of interest, shewing as they do, the connection subsisting between the electrical condition of the parti-

* These were made in the laboratory of Mr. K. T. Kemp, to whom I believe the credit of having first remarked the singular phenomena is due.

cles, of a body, and the arrangement of these particles in their definite forms, a point of so important a bearing on the nature of this enquiry.

At a future time, I trust to be able to add one more link to the chain of reasoning, by which the preceding results have been arrived at, by giving the details of a series of experiments on the effects of electrical currents passed through bodies in a state of fusion, from which I anticipate additional confirmation to the foregoing view of the cause to which the crystalline structure of trap, basalt, and other rocks of igneous origin is due, as well as that of certain sedimentary deposits, acted on, and altered, by heat of variable intensities.

Perhaps it may now be advisable to cast a retrospective glance at the ground over which we have passed, and to exhibit, by a short recapitulation, the steps of our enquiry, so as to enable the memory to retain the leading points the better, by divesting them of the intervening details. The object to be attained was to determine, as far as we could, the cause of the crystalline structure of trap and other igneous rocks. To this end analogous phenomena were classified, and discussed, their general bearing in regard to each other exhibited, and the bond of union, the point in which they are all agreed, was, in obedience to the laws of induction, considered as either the cause itself, or intimately connected with the cause of the phenomena in question. A law, based on the facts reviewed, was there expressed, at first limited in its application, but subsequently extended, by the discussion of other phenomena, till, commencing with masses in a state of intense heat, it gradually descended till it was found to apply to frozen water. The law of the connection of crystalline forms with variation of temperature, as exhibited in the 7 classes, was then more minutely examined, and, by its extended discussion, variation of temperature was found to be a fruitful source of one of the most active secondary agents in the natural world, viz. electricity. The peculiar case of trap dykes was chosen to illustrate the action of this power, into which the original one was now resolved. Its development, its efficiency, and its mode of action, were successively examined in detail, and analogies were brought to bear on these different points. The field of inquiry is yet far from being exhausted, the dependance of crystalline form on chemical composition as exhibited in the laws of isomorphism, the resolution of chemical action into the preponderance of different electrical forces, as lately proved by Dr. Faraday, the connection subsisting between heat, light and electricity, are all paths open to and inviting research, full of interest, and promising most rich and fruitful returns.

In conclusion, it may be permitted me to remark, that, in seeking to extend the domain of a power already so universal in its agency, so extraordinary in its nature, it is impossible to refrain from oft times having the heart raised to that God whose handy-work we are investigating, and to whose name I would desire to ascribe that tribute of praise, too often, I regret to say, withheld by many who devote their talents and time to laying open the secret laws by which He governs the world in which we dwell. It gives us no mean idea of his power to mark, how, with one instrument, such varied, such numberless effects are produced. Nor is this idea diminished, when we examine the nature of the instrument itself, and find it so worthy of an Almighty hand. Traversing space with a duration less than the millionth part of a second; passing through solid bodies more rapidly than light travels through the regions of the planets;* at one time rending rocks asunder, at another the obedient slave of man; contributing both to his wants, and his pleasures; residing in the magnet, it guides the sailor on his pathless way, labouring in the caverns of the earth, it is daily producing more abundant supplies of the various metals so necessary to man's social comfort and earthly happiness; nay, some would even lead us to suppose, that it is the great link by which world is bound to world, that the great principle of gravitation is to be merged into the still greater one of electrical action. Be this as it may, electricity is, even supposing it false, an instrument sufficiently wonderful to lead us to admire and to glorify Him by whom it was created, and by whom it is now directed in all its vast and varied operations.

* Such are some of the striking results to which Professor Wheatstone's researches on electricity have conducted him. I am indebted to Turner's Elements of Chemistry for a short account of these, Mr. Wheatstone has found—

(1) That the velocity of electricity along a copper wire exceeds that of light through planetary space.

(2) The light of electricity of high tension has a less duration, in passing as a spark, than the millionth part of a second.

In a letter to Dr. Buckland, Mr. W. says, in reference to the economical applications of this power, "it requires not the tongue of a prophet to foretel that the voltaic pile will hereafter create as great a revolution in our chemical manufactories as the steam engine has already effected in the mechanical arts."—Bridgewater Treatises.—*Notes*.

V.—*Notice of River Dunes on the banks of the Hogri and Pennaur.*—*By* Lieutenant Newbold, a. d. c. *to* Major General Wilson, c. b.

Passing through Honoor, a village about 20½ miles S. by E. from Bellary on the Bangalore road, I observed small ranges of sand hills, covering the black cotton soil to a considerable extent, that had very much the appearance of the dunes on the Malabar Coast. Not recollecting the vicinity of the Hogri river, I was at a loss to account for their appearance in this locality; but, on ascending one of the highest, I perceived the wide sandy bed of the river at a considerable distance to the west. This, and the clouds of sand blown in my face, were now sufficiently indicative of the cause of the elevation of these ambulatory hills. The direction of the ridge on which I stood was nearly north and south: it ascends from the west, *i. e.* from the river, in a broad sweep of drifted sand, covering the intervening land for nearly a mile, and terminating in a rather abrupt and steep descent, which falls to the east. This line is by no means regular; as the arenaceous phalanx advances most in those parts, where there is least obstruction from vegetation. One of these advanced dunes I observed, in the act of crossing the dry bed of a nullah. Many of them are prevented making progress by the embraces of the long fibrous plants that have grown up, and are interwoven with their substance: the *kaki beyru*, and *jihar chettoo* are the plants usually seen in this situation. Small fresh-water shells, principally univalves, have been carried along with, and imbedded in the sand: the wind has left ripple-like marks on its surface, and it only requires consolidation to transform the sand of yesterday into a rocky fossiliferous ridge.

On arrival at Honoor, the following information was given me by the head-man, and some of the oldest inhabitants of the place. The sand hills advance in an easterly direction, every year, during the months of June, July and August, when the western winds blow strongest. On an average they progress two, or two and a half yards annually. About eight years ago, when the rain was scant, and the wind unusually high, one of these dunes advanced on, and buried land under cultivation to the extent of more than eight chains, which has not since been reclaimed. During the famine about seven years ago, the dunes threatened to overwhelm Honoor, and the sand actually rose in the streets to the height

of five feet. In order to prevent the recurrence of such a disaster, the villagers allow the intervening *babul*, and other trees to grow, which they were formerly in the habit of cutting down. The present distance between the nearest sand-hill and the village does not exceed more than 400 yards. In the memory of the oldest native of the spot, the sand was confined to the immediate vicinity of the river banks: he attributes its advance to the cutting down of the jungle, and the comparatively dry seasons that have since prevailed.

The village of Bodurti, in the Conigul district, about three koss hence, was totally overwhelmed about 10 or 12 years ago. I visited the site of this village, and found it, with the exception of a foot or two of the old walls rising above the sand, completely buried under a large dune. The expelled inhabitants have built another village, not far from the site of its predecessor, whose name it now bears. I have met with sand dunes on the banks of the Pennaur in the Cuddapah district, and have ridden over the remains of an old village and pagoda, in the vicinity of Jummulmudgoo, now completely covered by the sand. They occur also on the Malabar Coast, and contribute greatly to the formation of those singular lakes of sea and fresh-water, termed back waters. These sand hills resemble the dunes extending from the mouth of the Garonne to the district of Bayonne, described by De la Beche, blown up by the westerly winds, and preventing the drainage of the country, and forming marshes in their rear. It would be worth while to examine the deposit now forming in the Malabar back-waters. In those of the Garonne are often found alternations of marine, fresh-water and terrestrial deposits.

VI.—*Extract of a Letter from Captain* J. A. Smith, *Civil Engineer 1st Division, dated* 3*d April* 1839, *on the Table land of Cumbaucum Droog.*

(Communicated by the Madras Government.)

I have visited and examined the table land in the vicinity of the Pulicat lake, described by Lieutenant-Colonel Monteith in the Madras Journal of Literature and Science, No. 12.

The hill on which this table land is situated is part of a ridge connected with the eastern range of ghauts, and is known by the name of Cumbaucum Droog, the inhabited spot adjoining to it being a village in the Calastrie Rajah's territory, called Tallaripett, distant about 10 miles from the Pulicat lake, the nearest points of which are at Tudda and Bolingarpollium, both situate on the high northern road.

From Tallaripett the distance is about three miles, the road winding through a thick jungle to the foot of the hill. The ascent is irregular and in some parts steep, but although there is no formed road there is little difficulty in reaching the table land, which may be done on foot, or even on horseback. The length of the ascent is about four miles.

On completing the ascent, a comparatively level surface, of fully two square miles in area, is met with, the general appearance of which is that of a flat basin surrounded by bluff ridges in every direction, and intersected by ravines. The soil appears to be good and is said to have been productive and fertile, there are traces of cultivation, and the ruins of a pucka building were pointed out to me.

On my first visit to this spot on the 8th ultimo, a series of barometrical observations was made for the purpose of ascertaining the height of the table land above the level of the sea, the result of which gave an altitude of about 1650 feet; that of the nearest adjoining peak to the eastward of it, being nearly 1900 feet.

On a subsequent visit on the 28th of the same month, a fresh series of observations gave the altitude of the table land nearly 1700 feet, and that of the highest of the surrounding peaks, viz. of one distant about three miles to the south-east of the ruins before mentioned, about 2300 above the level of the sea. On the first visit the thermometer in the shade of a tree stood at 80° to 81°, at 10½ and 11 A. M., a strong southerly wind prevailing at the time, and the sensation to the feelings being cool and

agreeable. On the 28th a dry hot wind was felt at intervals, and the heat was very oppressive; the thermometer standing at 98° and 99° at noon in a tent, and the air being parched and scorching. The water, however, procured from the reservoir in the bed of the torrent, which passes down a ravine intersecting the table land, and which being supplied from internal springs may be considered to represent the average temperature of the spot, was found, even in the latter visit (the 28th), to possess a temperature of only 64°; so that the occurrence of the extreme hot weather then experienced is the more remarkable, and may be perhaps an unusual circumstance.

The supply of water appeared to be abundant, and it was of a limpid clear appearance. It is also considered of good quality by the natives in the neighbourhood, but various streams which I tasted had all a bitter taste, which was accounted for by the natives from the circumstance of the water-courses being choked with leaves and vegetable matter, and it is not improbable that that objection would be obviated by clearing them out, or by deriving the supply required from wells.

The fact that this elevated region is not exempt from the occasional influence of the hottest winds, may perhaps be considered likely to defeat its usefulness as a sanatarium for invalids; and to take away considerably from the beneficial effects which its bracing atmosphere might at other seasons offer.

V.—*Fifth Report of Progress made in the Examination of the* Mackenzie MSS., *with an Abstract Account of the Works examined.—By the Rev.* William Taylor, *Member of the Madras Literary Society, &c.*

A.—TAMIL.

a. Palm-leaf Manuscripts.

1. *Cási-Cándam,* or the section of the *Scánda purâna* which relates to Benares.

No. 9—Countermark 51.

This is a large manuscript, though forming only a part of the *Scanda purana.* It is written in the kind of Tamil verse termed *Viruttam,* a difficult kind of measure. Its translation into this metre is ascribed popularly to *Ádi-vira Pandiyan,* which is the case with several other works, too numerous to be probable; except possibly as regards patronage of the different authors. But the ascertained fact, that the College at Madura was founded with a special view to the transfusion of Sanscrit works into Tamil, and for the spread of the *Hindu* religion in the extreme south, may account for many dedications or ascriptions of works to one king. There is a reference in this poem to the passage of the *Vindhya* mountains by *Agastya,* extravagantly hyperbolized, but the greater portion relates to the river, and *tirt'has* or pools, to shrines, and to the legends of individual devotees at Benares. The *Cándam* or book is divided into one hundred *Adhyáyas,* or subdivisions. A specification of the contents of these *adhyáyas,* with a brief occasional explanation may suffice as regards this document.

1. *Nareda's* inspection of the *Vindhya* mountain. *Nareda* taunted the *Vindhya* mountain with being inferior to *Maha-meru* in size, and also inasmuch as the sun turns round *Meru* in its course. The *Vindhya* mountain, feeling itself insulted, elevated its summit even to the skies.

2. The celestials visit to *Brahmas'* world. As the *Vindhya* mountain had obscured the light of the sun, the celestials went and complained against it to *Brahma,* who referred them to *Agastya.*

3. The visit of the celestials to the hermitage of *Agastya.* They made known to him the haughtiness of the *Vindhya* mountain.

4. The praise of matronly chastity. The celestials describe the wife of *Agastya*, as a pattern of matronly virtues

5. The visit of *Agastya* to the *Vindhya* mountain. *Agastya* went near to it, when it bowed down, and paid homage at his feet. *Agastya* said "I am going to *Pothaiya*, and until I return remain always thus", a command which could not be broken.

6. Account of the *Tirt'has.* The virtues of the river Ganges are stated, and those of many other rivers, and reservoirs connected therewith, of superior efficacy in the removal of crimes.

7. The praise of towns adjacent to Benares. These places have their excellencies declared.

8. The account of *Siva-janma* and *Yama.* The former was a royal devotee, at whose death *Yama* took his soul.

9. The visit to the solar orb. *Yama* took the said persons soul, and shewed it that world.

10. The visit to the world of the celestials. *Yama* shewed this world to the soul of *Siva janma.*

11. The visit to *Agni-loca. Yama* shewed to the disembodied soul the worlds of fire.

12. The visit to the quarter of *Nairiti*, guardian of the south-west.

13. The visit to the quarters of *vayavu*, and *Cavéra*, regents of the north-west and north-east quarters.

14. The visit to the world of *Isvara*, and *Chandra.*

15. The visit to the worlds of *Táraga*, and *Budha*, or the starry sphere, and the planet Mercury.

16. The visit to *Sucra-loca*, or the planet *Venus.*

17. The visit to Mars, Jupiter, and Saturn.

18. The visit to the regions of the seven *Rishis*, or the north polar celestial sphere, especially *ursa-major.*

19. The visit to the *Dhruva-mandalum*, or north polar-star ; the said visit, like the preceding ones, being performed by the soul of *Siva Janma* under the guidance of *Yama.*

20. Eulogy of *Dhruva.*

21. Apotheosis, or beatification of *Dhruva.*

22. Visit to *Maha-loca* and the four other superior worlds.

23. The coronation of *Vishnu*, as seen by *Siva-janma.*

24. *Siva-janma's* beatification. As this king had, during his life, been a great benefactor, and had abounded in liberality, so after his death

Yama took him on the long celestial pilgrimage* above intimated; at the close of which he obtained full beatification.

25. The visit of *Agastya to Subrahmanya.* On occasion of this visit *Subrahmanya* conducted *Agastya* through *Benares*, and explained to him its various distinguishing features and excellencies.

26. Eulogy of the female sex at Benares, by *Subrahmanya* to *Agastya.*

27. Eulogy of the Ganges; in the same way narrated.

28. The depositing of bones in the Ganges. If the bones of those who die be deposited in the Ganges, the beatification of the departed is assured.

29. The specification of the thousand names of the river Ganges.

30. The praise of *Váranasi* or Benares. The *morality* of this *adhyáya* is observable. A woman entertained an improper affection for her own son, who remonstrated, and denounced on her total destruction. But on her death, advice was given to cast her bones into the Ganges, at Benares; in consequence of which her soul attained to *Sverga.* Hence *Casi* acquired the name of *Varanasi*†

31. The manifestation of *Bhairava* a terrific form of *Siva.*

32. The manifestation of *Tandapàni.* A devotee paid homage to a form of *Siva*, and received favour from so doing.

33. The magnificence of *Casi*, declared to *Agastya*, by *Subrahmanya.*

34. The beatification of *Calavati.* The legend of a woman, who took permission from her husband to quit domestic life; and, going to Benares, acquired beatification.

35. The declaration of household order. This section relates to the duties of those not devoted to an ascetic life, or the *Grihasthas.*

36. The duties of the order of *Brahmà chari* or religious novice.

37. The excellencies of the female sex: a eulogy of their perfections.

38. The duties and deportment of the *Brahmanical* order.

39. The duties of alms giving, by householders.

40. The deportment of *Saiva*-ascetics: rules as to their diet, and general conduct.

41. The knowledge of fatal indications. Certain signs are specified, by which a person may know the near approach of death. In such

* In this extensive celestial tour, the narration of which occupies from section 9 to 24 there is a sort of wild sublimity; upon the whole very superior to some puerilities of Byron; written, it may be conjectured, under like inspirations. *See his Cain.*

† See Wilson's Sans. Dict. 1st edition, page 796, or 2d edition page 735 for the derivation of the name. The above passage would seem to indicate a different one.

cases, in whatever place he may be, he is recommended to repair to Benares, that he may thereby attain beatification.

42. Account of *Abimutesam.* This person by great devoteeism to *Siva,* obtained much approbation, and many secular advantages.

43. The story of *Tilotattan ;* in subject, resembling the preceding.

44. The magnificence of *Casi,* again declared.

45. The visit of ascetics to *Casi* for the purpose of obtaining beatification.

46 to 51. Legends of individual devotees, at *Casi.*

52. Account of *Brahma's* sacrifice.

53 to 57. Visits of deities to *Casi.*

58 to 85. Legends of individuals, and formation of images, bearing some of their names.

86. The sacrifice of *Dacsha.*

89. The same subject continued.

89 to 99. Different legends of individuals.

100. A brief repetition or summary ; and description of the homage paid to the emblem of *Siva.*

Remark.—From this very brief indication the prevailing inanity, and wiliness, of the work may be inferred. The *St'hala puranas,* or local legends, of most of the distinguished *Hindu*-fanes, are drawn up generally on the same model. The bearing of such documents on the explanation of manners, and mythlogy, is very important. As to history there is, I conceive, nothing in this document of any value.

Note.—The manuscript is of comparatively recent hand-writing ; remaining fresh and uninjured. It is entered in the Des. Catal. vol. 1. p. 166. Art. X.

The following are Tamil versions from the great epic poem the *Ramáyana.*

2. *Ramayana,* No. 1.—Countermark I.

This manuscript contains a copy of *Camban's Ramayanam,* down to the end of the fifth *Candam,* or book ; and by consequence including the *Bála—Ayódhya—Aranya—Kishkinda* and *Sundara*-books, or *Cándams.* So far the work is complete ; and so very slightly injured that it may be considered to be in good state of preservation. It is entered in Des. Catal. vol. 1. p. 163. Art. I.

3. *Yuddha Candam,* No. 2.—Countermark 2.

This manuscript, which is equal in size to the foregoing one, contains the sixth book in continuation of the preceding, narrating the war with *Rávana.* It is also in good preservation. With this book, strictly speaking, the work of *Camban* concludes. It differs, in some minor particulars, from the Sanscrit poem by *Válmica.*

It is entered in Des. Catal. vol. I. p. 164. Art. IV.

Remark.—The *Uttara Candam* or supplement is wanting in the above copy. That supplement relates to the ancestry and family relatives of *Rávana.* Tradition ascribes its authorship to *Otta Cuttan ;* but adds that *Camban* approved it, and incorporated it within his own work ; an addition which seems doubtful.

4. *Aranya, Cándam*, and *Kishkinda Cándam* or 3d and 4th sections of the *Ramáyana*, No. 4.—Countermark 2.

In this copy the 1st leaf, the 49th and a few leaves at the end, are wanting. The M.S. is very old, and much worn away at the edges ; having also one or two leaves broken; but it is untouched by insects. The necessity of restoration is obviated by the existence of a complete copy in No. 1.

This manuscript seems to be part of one uniform copy, together with the two following portions, which in every respect resemble it, in external appearance, in age, and in the hand-writing. Such being the case the copy wants the two first sections, or the *Bála*, and *Ayódhya Cándams.*

5. *Sundara—Cándam*, No. 5.—Countermark 3.

The copy is complete ; the leaves are a little injured, the M.S. being very old, but not to any serious extent.

Consequent on the above remark, the sixth section, or *Yuddha Cándam*, is wanting.

6. *Uttara Candam*, No. 3.—Countermark 5.

This copy is complete; very old ; and only slightly injured.

That this copy belongs to the preceding second series, is determined by its appearance, and general characteristics, which forbid its being considered as a supplement to Nos. 1 and 2. However being taken with 1 and 2, it forms a complete copy of the entire work ; and one copy complete, as to matter, I deem sufficient for the collection.

Remark.—I have been informed that a prose version complete was made of Camban's poem by *Srinavasa pillai,* for R. Clarke, Esq. part of the expense having been borne by Judge Gwillim, and J. Gwatkin, Esq. I have not seen that version.

7. *Ramáyana váchya* a prose version of the *Ramayana,* No. 6.—Countermark 6.

In the title *Cavi* (or poetical) is added, but this is wrong, the whole being prose, of an ordinary kind. It is a rather large manuscript, in good order, and complete.

A man of the *Vaniya* class is said to have gone every night to hear the *Ramáyana* of *Válmica* recited and explained by a *Brahman,* according to the usual custom of such public recitations; and the next day to have written down the substance of what he had heard. By this means he completed an epitome of the original work; which hence familiarly acquired the name of *Válmica Ramáyana;* because following *Válmica* implicitly, which the poet *Camban* did not do. It is not requisite, I believe, for me to abstract the contents: a general notion of the story of the *Ramáyana* being, it is presumed, very common.

The book is entered in Des Catal. vol. I. p. 165. Art. IV. as "a prose version of the *Ramáyana* attributed also to *Kamban;*" by whom attributed is not stated. The *Ramayanam* by *Camban,* is a first rate work; this one of very mediocre character and pretensions. There are two other prose versions; but neither of them by *Camban,* who was strictly and solely a poet.

8. *Ramayana,* another (incomplete) copy.

This book it may be supposed originally contained the whole of the second division of the *Ramayana,* or the *Yudha Candam,* and *Uttara Candam,* but in its present state it wants 199 leaves from the begining of the *Yudha Cándam,* and is thence complete to the end of the *Uttara Cándam.* At the close there is a superscription signifying that it was written, or compiled, by *Vasudeva-pillai* for Dr. Mitchell. The said *Vasudeva-pillai,* I am informed, was a schoolmaster at Tanjore.

This version, like the last mentioned copy (No. 6) follows the original of *Válmica;* but it is much more full. This imperfect manuscript is equal, in size, to the whole of the said epitome.

However apparently it belongs not properly to the Mackenzie collection. It has nothing whatever of the outward adorning bestowed on the Mackenzie palm-leaf MSS. is of the plainest possible appearance, has no label or number ; and none of the usual marks of having passed through the hands of Prof. Wilson ; only the name *Ramáyana* in Tamil letters written in ink, on one of the boards. Hence I look upon it as a MS. more recently introduced to the collection, by whom, or for what purpose, cannot be stated.

The following manuscripts are Tamil versions from the *Mahábharata.*

9. *Sabha-parva* the second book of the *Bharatam*, No. 46—Countermark 7.

10. Another copy, No. 47—Countermark 7.

Both of these manuscripts contain an inferior version of the above-mentioned portion of the *Mahabharata.* It is said to have been a production of one *Nangai*, a *Brahman* woman, and to be known familiarly by the name of *Nanga-páttu* (or the chant of *Nangai*). The versification is plain, and of common order, adapted to the comprehension, and pronunciation of women, and occasionally is sung about the streets in ballad style.

The first of the two copies is in regular and good order, and complete: the other copy is damaged and very imperfect, at the begining, but being part of the same work the damage is of no consequence.

What remains proceeds as far as to the sojourn of the *Pándavas* in the wilderness; and thenceforward is what is termed *Pulantaran dutu*, being an account of the sending of a son of *Arjuna* to the household of *Duryodhana*, and his deportment there. The former part seems to be only introductory to this latter portion, which latter portion is complete. By consequence this manuscript is improperly entitled *Sábha-parva* ; being a work differing from the *Bháratam.*

11. *Udyoga-parva*, No. 48—Countermark 48.

This book contains not only the whole of the above mentioned section of the Tamil *Bháratam*, but also a portion of the *Yuddha-parva*, down to the seventeenth day's combat. It has the appearance of age ;

but is in extremely good preservation. It is part of a version by *Vili-puttur-áluvàr*, and is commonly termed *Aluvàr pádal* ; which version is esteemed the best of three others by *Hindu* poets. The inferior versions are by *Nala-pillai*, and by *Rangha-náthapuluvan*. This copy, it is scarcely necessary to add, is in elegant Tamil verse.

12. *Yuddha-parva*, No. 49—Countermark 6.

This manuscript contains the whole of the above mentioned section of the *Bhárata*, in an inferior kind of versification, by an obscure or unknown author. It is supposed to be part of a version made by some one of the *Paria* tribe, who are reported to have such a version among themselves.

One-half only of the book contains the said section. The other half is a portion of some work on medicine, by whom written is unknown. It is not complete either at the beginning, or end ; and is damaged, by the edges of some leaves being broken off.

Note.—Six portions of the Mahabharata are entered in the Des. Cat. vol. 1, p. 165, art. vii. I do not find more than four MSS. now remaining.

12. *Hanumanta-pattu* a chant in praise of *Hanuman*, No. 204—Countermark 182.

This is a book, very small in size, and brief as to contents. It contains ten stanzas, as a eulogy of *Hanuman*, for the assistance rendered to *Rama* in the war against *Lanca*. The eight diminutive leaves on which the book is written are much damaged by insects.

There is an appendix of eight similar leaves, of which only four are written on ; the contents being an unfinished poem in praise of a local goddess, termed *Periya-nayaki-amman*, in good preservation.

It is entered in Des. Cat. vol. i. p. 228, art. lii.

13. Trincomalee *St'hala puranam*, or legend of the fane at Trincomalee Nos. 17 and 18.—Countermark, 25 and 26.

It is termed *Arnáchella puranam* in the manuscripts.

It contain 12 *Sargams* or sections. A brief abstract is here offered.

1. The first *Sarga* has the usual invocations and eulogies, and announces the name of the writer or author, that is *Yellapa-Vádhyar* of the *Saiva* class, who states that he translates into Tamil, from the Sanscrit original by *Vyasa*. It was originally delivered by *Nandi* to *Márcandeya*, by *Márcandeya* to *Vyasa*, by him to *Suta*, and by *Suta* to the *rishis* of the *Naimisara* wilderness.

2. This section contains the legend on which the distinctive name of *Arnachellam* is founded. *Siva* appeared as a fiery mountain, and to settle a dispute between *Brahma* and *Vishnu*, as to which was the greatest of the two, they agreed to try if they could, to discover either the foundation or the summit of the mountain. *Brahma*, assuming the shape of a goose or swan, flew upwards, and *Vishnu*, in the form of a boar, dived downwards. The latter returned and stated that he had not succeeded in discovering the foundation, but *Brahma* came back and said he had seen the summit, bringing a flower* suborned to bear false witness. *Siva* in consequence doomed *Brahma* to be without fanes or worshippers, for his falsehood, and declared *Vishnu* to be superior to *Brahma*, though confessedly inferior to himself.

3. This section in the commencement narrates *Dacsha's* abuse of *Siva*; the sacrifice of *Dacsha* to which his daughter the wife of *Siva* desired to go, and going perished; in consequence *Siva* (it is here said) produced *Vira-Bhadra* from his frontlet eye, who went and destroyed the sacrifice returning afterwards to *Cailasa*. Subsequently, while *Siva* was performing severe penance, one *Sura-padma*, an *asura*, acquired so much power as to trouble both gods and men. Complaint being made to *Brahma*, he announced the future marriage of *Siva* with *Parvati*, and also the birth of *Subrahmanya* by whom the *asuras* would be destroyed. *Indra* sent *Manmatha* to destroy the penance of *Siva*, and *Siva* opening his frontlet eye reduced the assailant to ashes. Subsequently *Siva* returned to *Cailasa*, where the celestials represented to him the expediency of marrying *Isvari* the daughter of *Parvata-rayen* (or the mountain king) to which he consented, and the marriage was conducted with the customary state and splendour. At the prayer of *Reti*, *Siva* pardoned *Manmatha*, who came and paid homage without any visible form, in consequence of his body having been turned to ashes. The oppression exercised by *Sura-padma* being stated to *Siva* he produced six fires from his frontlet eye, by the union of which *Subrahmanya* with six faces was

* The Kétaki, or Pandanus odoratissimus: which, partaking of the curse, is never used by the Hindus in honouring the gods.—*Editor.*

born. He fought with and conquered the *asuras* and having done so returned to *Cailasa.*

4. After the marriage ceremony was over *Parvati* asked *Siva* what were the sun and the moon; he replied they were his two eyes; whereupon *Parvati* shaded both eyes with her hands; the consequence was universal darkness over the world; and all beings lost the use of their eyes. *Siva* incensed opened his frontlet eye, and dissipated the darkness. *Parvati* was doomed to do penance on earth, which she did under a mango-tree at Conjeveram. and there erected a small image of earth. She subsequently went on a visit to *Arnache'lam,* and thither *Gautama* the *rishi,* and others, inclusive of *Siva* himself, also came.

5. This section in the commencement relates to *Mayadasura* who in a former birth, for a fault committed, was condemned to be born as a buffalo. Acquiring great power *Isvari* sent for *Durga* to go and kill him. A combat took place in which *Mayadasura** was slain. An emblem of *Siva* arose out of his remains. Subsequently *Siva* came to *Arnáchellam* on his bullock vehicle, and there incorporated *Isvari* into his own form, so that on the right side the form of *Siva* was presented, and on the left side that of *Parvati.*

6. This section contains the story of *Vajranga Pandiyan,* an abstract of which was before given, from a copy of this *Sarga* in a manuscript book. See 2d Report A. Tamil M.S. book. No. 20 section 5.

7. Notice of the *tirt'has,* or sacred pools. A *Brahman* sprung from the perspiration of *Gautama rishi,* at *Arnache'llam.* He became hierophant to the fane. Seven females were born from seven blades of *Darb'ha* grass, who became *danseuses* to the god. To the east of the fane is the *Indra*-pool. *Indra* bathed therein; by doing so removed his former defect; and obtained prosperity, co-existent with the sun and moon. To the south-east is the *Agni*-pool. If any one bathe therein at the full moon in *Panquni* (March-April) the doing so will remove the crime of infanticide. At the foot of the hill is the *Yama*-pool. If any one bathe therein the body will be healed of disease, and a golden coloured form acquired. Also at the foot of the hill is the *Nairiti*-pool; all sins are removed by bathing therein. On the west of the hill is the *Varuna*-pool. By bathing in it, the advantages bestowed by the nine planets are acquired. Beyond is the *Vayvu*-pool; by bathing in it all sorrows depart. On the north side is the *Cuvéra*-pool; by bathing in which poverty is removed, and wealth acquired. Near to it, towards the east, is the pool formed by the two *Asvinis.* If any one bathe in

* The *asuras* of this class had faces like buffaloes.

it, he will approach the feet of *Paramèsvarer* (or obtain beatification) after death. To the east of the before mentioned *Yama*-pool is the pool of *Agastya*. Those who bathe in it will acquire *Sarasvati* and *Lacshmi* (intellectual skill and outward abundance). There is also the pool of *Vasishta*. If any one bathe therein in *Arpisi* month (September-October) he will acquire all the learning of the age. There are besides, says the *Purana*, many other *tirt'has*, the merits of which cannot be told. To the north of the hill is a river, *Nri nadi*, the effect of bathing in which is to cause *Lacshmi* to dwell with *Vishnu* (or to produce order and plenty). Other rivers are mentioned, which remove crimes. Besides there is the *Punya*-river *(vulgó Pouniar)*. A certain king bathed in it, and changed an effeminate to a masculine form. The *Cheyàr* derives its name from a weapon of *Subrahmanya*, the *vél*, which he dropped into it, and recalled. There is within the fane of *Trinomali*, the pool of *Siva*. If any one daily think on it, all kinds of crime will be removed. To the east of it is the *Chacra* reservoir. During the *Varàha-avataram Maha Vishnu* bathed therein, and by doing so acquired all the glory connected with the high office of *Vishnu*. All who bathe in it will obtain health. Finally there is the pool of *Brahma*. By bathing therein, all the evils that float in the sea of this life will be removed, and eternal happiness acquired. If any one on its bank give a bit of gold, however small, he will acquire possession of all that is enclosed within the seven seas surrounding the world. If a cow be so given, the merit of the gift is beyond the power of words to describe. If any one so give a white cow, such a one will ascend to *Cailasa*, on a white (or silver) vehicle, and be praised by all the residents there. If any one give a marriage dower on its bank, such a one will visit the *Satya-loca* (world of *Brahma)*; and afterwards permanently obtain to the paradise of *Siva*. If any one give a donation of land, the reward is too great to be described. If any persons cause a pond, or well, to be dug at *Arnàchellam*, they will acquire the prosperity of *Indra*. Further, on the place of sacrifice there being a little dust, a crow flying by swept off the said dust by the concussion of air from its wings, and *Siva*, in return for the unintentional service, gave the crow beatification. Besides a large kind of rat (bandicoot), from delving in the ground, cast up a jewel *(mànicyam)* before the shrine; and the god, saying it had supplied him with a light, gave a gracious reward. A spider spinning a web in the shrine, the god was rejoiced in being supplied with a garment, and caused the spider in the first place to be born a king, and afterwards to be beatified. Such, says *Suta* to the *rishis*, is the glory of the fane of *Arnachellum*.

8. This section specifies the rewards consequent to walking round the hill, and to bathing on certain days of the week. For example, to walk three steps when circumgyrating the hill is equal in merit to the performance of an *asvamed'ha* sacrifice. To bathe on Sunday, secures the bliss of *Paremesvarer;* on Monday, secures not only equal power to that of *Indra* over the seven worlds, but also a form like that of *Siva;* on Tuesday, removes poverty, secures wealth here, and beatitude hereafter; on Wednesday will give the power of acquiring all magical knowledge and secures beatification; on Thursday will give the privilege of becoming *guru*, or spiritual preceptor, to the *Trimurti* or *Hindu Triad;* on Friday will secure the beatification of *Vishnu's* world; on Saturday will secure perfect happiness, and is equal to the merit of bathing on the night of *Siva*, at the new-year, and in the months of *Arpisi*, *Carticeya* and *Margali* (or October, November and December). The contents of this section were narrated by *Brahma* to *Sanaca*, the great sage.

9. *Brahma* to *Sanaca* in continuation, declares the extreme penalties incurred by those who presume to say any thing against the shrine of *Arnachellam*, involving death, seizure by *Yama's* messengers and severe punishment in *Naraca*, or the lowest hell. *Brahma* continues stating that the thousand-rayed sun, coming rudely with his horses and chariot, to the point, or peak, of the hill, was reproved by him *(Brahma)* and told to go and pay obeisance to the lord of the shrine. The sun paid homage, which was accepted, and he now uniformly passes to the left (north) side of the hill.

10. The legend of *Pradatya-raja*. *Brahma* tells *Sanaca* the extreme punishment incurred by those who presume to steal any thing from the shrine of *Arnachellam*, being seizure by *Yama's* agents, and consequences, as in the last section. An example is given in the case of *Pradatya-raja*, who came from the north, and coveted a part of the possessions of the fane, for which his face was turned into that of a baboon, and on seeking pardon for the fault, his proper countenance was restored; by consequence no one can with impunity covet the possessions of this shrine.—See a fuller abstract of the contents of this section 2d Report Tamil MS. book No. 20. section 4.

11. This section relates to the removal of crimes. *Brahma* tells *Sanaca* that the eight *Vasus* (or leaders of celestial hosts) becoming vain and proud of the merit of their penances, and performances, boasted of the same in the presence of *Agastyar*, who denounced on them loss and degradation. To recover their former situation they were directed to go and do homage at *Arnachellam*. Accordingly the eight *Vasus* did homage, at the eight points of the compass, and were restored. Other crimes

among celestials are specified, as removed at this shrine. Among them *Chandra* (or the moon) committed a fault in reference to *Rohini* and was punished by *Dacsha*, but the punishment was removed by paying homage here.

12. This section relates to *Pulacatipa*, an *asura*, who provided the perfume of civet for the shrine, and acquired great merit for so doing. Since then civet-cats are kept, and the reward of offering that perfume is very great. A recapitulation of the transit of the contents of the *Purana*, down to its latest delivery to the *rishis*, with the mention of which the book ends.

Note.—The MS. No. 27 is complete. It is old and somewhat damaged by insects. The MS. No. 18 is fresher in appearance; but also a little damaged. The damaged leaves in this copy I have had restored by the aid of both copies, and one being complete may suffice. Both MSS. are in verse with a prose explanation. They are entered in Des. Catal. vol. 1, p. 168 art. xvii.

Remark.—If the reader shall have perused the foregoing abstract, it will be only necessary further to observe, that in *Saiva* fanes of the Peninsula, to local *Puránam*, and not the *Vedas* gives the religion of the votaries.

14. *Dandi Alancaram*, or the rhetoric of *Dandi*, No. 63—Countermark 220.

In this book there are two copies tied up together. The first copy contains the *mulam*, or original poetical stanzas of *Dandi*, together with exemplifications or examples, and is complete. The second copy contains the original *sutras* together with the *urai* or commentary, in verse, by some other unknown author; added to which are the exemplifications. This last copy wants a few leaves at the end of the commentary. The book is a little injured in one or two places, by insects; but not seriously. The work is not scarce.

Dandi next to *Calidasa*, is said to have been the most celebrated poet at the court of *Bhoja-raja*. He has the traditionary reputation, in the Peninsula, of having been *Ubaya-cavi*, or a poet in two languages, the Sanscrit, and the Tamil. The above work is on thirty-five kinds of poetical, or rhetorical, ornament; and, with reference to the Tamil art of poetry, the work is considered to be valuable.

This book is briefly entered in Des. Cat. vol. i. p. 252, art. vi.

15. *Jataca Kerala alancaram*, a treatise on astrology No. 69—Countermark 233.

This manuscript is a poem of one-hundred palm-leaves; probably written according to the notions of astrological science prevailing in the *Keraladesam*, or *Malayalam* country. It has a great variety of details on different circumstances, occurring in the course of life; respecting which mankind have usually been found to have an anxious eye directed towards the future. A full detail, as to native ideas on astrology, is quite requisite to a knowledge of their manners, or motives, or guiding principles.

Astrology is inseparable from their mythology, and both, to an amazing degree, influence the conduct of a *Hindu*. Both tie him fast under Brahmanical ascendancy. An exposition of *Hindu* astrology, by a verbal translation of recognized systems, seems to me desirable. It would be a more than usually difficult work, and might require the undivided attention of some one individual, for some length of time. Without a knowledge of the *local* mythology, and the received astrology of any portion of our *Hindu* fellow subjects and fellow men, it seems to me that legislators, and religious teachers, must equally labour in uncertain twilight, without a clear discernment of the subject on which they operate.

Note.—The book is entered in the Des. Cat. vol. i. p. 255, art. vi.

16. *Navya-sastra*, or the art of building and navigating vessels, No. 78—Countermark 259.

Some directions are given respecting the materials, and dimensions, of vessels. But the work is chiefly astrological; in matters relating to prognostications concerning navigation. At the close there is a leaf or two on the *raja-yogam:* children born under that astrological sign will acquire very great success, and prosperity.

Remark.—Seven leaves of this tract were recovered from MS. No. 97, and being added to the beginning of this document render it now complete. It is also in tolerably good order, and written in a very legible hand. It seems to be a work of somewhat ancient composition.

The *Sutras* are without commentary.

It is entered in Des. Cat. vol. i. p. 261, art. ii.

17. *Rangha Calampacam,* or incense to *Vishnu,* No. 144—Countermark 167.

18. The same (duplicate) No. 145—Countermark 202.

This is a poem of one-hundred stanzas, in praise of *Rangha,* a name of *Vishnu* at *Sri-rangham* and other places. The word which I have rendered "incense" signifies more properly a mixture of odoriferous perfumes, of which I need not extract the quintessence. It is also a technical name of one class of Tamil *Prabandhas,* as containing a mixture of various poetical measures. The first manuscript is perfect and uninjured, the second copy is somewhat damaged by insects, and will require to be looked at occasionally, though its restoration is not immediately urgent: it is otherwise complete.

One copy is entered in the Des. Cat. vol. i. p. 225, art. xxxix; but without any mention of a duplicate; both MSS. bear the usual marks.

19. *Siva-vacya-padal,* or the chant by *Siva-vacyar,* No. 132—Countermark 132.

This is a didactic moral poem, characterized chiefly by its monotheistical purport. It is very severe on idol worship, and on various abuses connected with the common *Brahmanical* system: maintaining the necessity of rejecting the names of *Siva* and *Vishnu,* and worshipping one only god. Hence it has always been made great use of by native Christians in disputing with *Hindu* natives. I was told some years ago that the *ascetics* (or *Pandarams*) of the *Saiva* class, seek after copies of this poem with avidity, and uniformly destroy every copy they find. It is by consequence rather scarce; and chiefly preserved by native Christians.

This copy is complete, as to the No. of palm-leaves, but very much injured by insects. Collating it with a copy heretofore belonging to the late Dr. Rottler, now in my possession, I have had one good copy carefully restored.

Note.—It is entered in Des Cat. vol. i. p. 225, art. xxxvii, as containing "stanzas in praise of *Siva* as the only supreme or *Paremesvara.*"

20. *Naladi-pada-urai*, No. 99—Countermark 208.

21. The same work, No. 100—Countermark 209.

These two manuscripts are copies of a moral work, the contents of which relate to the duties proper to various ages of life, particularly those of penance and alms-giving, on which latter subject there is much said, and much on the use, and abuse, of riches. Certain evils and crimes, are denounced as leading to future punishment in *Naraca.* The work is of superior composition in quatrains; and as each line is termed in Tamil poetry a foot, hence seemingly came the title of *Naladiyar*, by which it is popularly, and respectfully, denoted that is "the respectable four lined one."

It is ascribed as regards authorship to the *Samanar* (*Bauddhists*, or *Jainas*). and had the rare merit of being spared by the bigotted *Brahmans*, when they destroyed all other books of their opponents, by casting them into the *Vaigai* river at Madura; after the triumph of the *Saivas* in the reign of *Kuna Pandiyan.* The story is that, whereas all the other books went down with the stream, this one ascended *four feet* against the stream, by reason of which wonder it was taken out and preserved. This tale is however merely symbolical. A better reason may be its being free from sectarian peculiarities, and available to the advantage of *Brahmanism.* In the same manner the *Cural* passed the *Brahman*-ordeal, for a similar reason; but not without a symbolical tale being invented to give a colour of reason, and to render the acceptance of a *Pariar's* work pardonable.

Remark.—As a moral didactic work esteemed to possess high merit, invested with the sanction of the Madura college and being of high popular repute, a good translation of the *Naladi-pada-urai*, well edited, would be an acquisition; and I am happy to learn that such a version is in progress in able hands. The poem does not easily admit of being abstracted except in a brief indication. The two copies are complete, and in tolerably good preservation. The first of the two is the most recently written. They are entered in the Des. Cat. vol. i. p. 246, art. lxxii.

22. *Ulaga-niti*, a treatise on morals, No. 186—Countermark 191.

This is a very concise little book, chiefly consisting of brief prohibitions against vices or evils; with a few at the close declarative or hortatory. It is a school-book for children: but in the higher dialect. The authorship is ascribed to *Ulaga-nat'ha*; who, though his name signifies "lord of the world," was a man of the barber tribe. The title may be rendered either "worldly rectitude", or *Ulaga's Treatise* on Morals. The latter I suppose to be the right rendering.

Note.—The manuscript is fresh, and in good condition. It is entered in the Des. Cat. vol. i. p. 231, art. lx.

23. *Adi Chudi Venpa*, No. 174—Countermark 204.

24. Another copy, No. 175—Countermark 205.

These are two copies of a didactically sententious and moral work, used in schools, ascribed to *Avvai* or *Avvaiyar*; a sister of *Tiruvalluvar*, author of the *Cural*. Her name, like his, is merely titular: what may have been the proper name of either is uncertain. This work was entitled by the authoress *Niti-chol*, "a word on morals," or as it may be rendered, "a discourse on rectitude;" but some later writer prefixed stanzas of invocation addressed to *Siva*, or *Ganesa*, using the words *àdi-chúdi*, at the beginning of his panegyric, whence the book has improperly acquired its popular title. The alphabetical order is followed, beginning each line or sentence at first with the vowels, and then with the consonants, and syllabic letters. Hence the two-fold object is subserved of fixing the alphabetical order in memory, and of ingrafting, upon the whole, useful precepts. A translation by Dr. John, of Tranquebar, was inserted in the Asiatic Researches. When the book is used in Christian schools, the spurious prefix of praise to false deities is rejected.

Note.—No. 175 is complete, and makes rather a large book, owing to very little being written on each leaf. It is injured by insects. No. 174 in addition to the *Niti-chol*, in a compressed form, has prefixed the *Tandaliyar-satacam*, a poem containing praise addressed to *Siva*. There are 86 stanzas out of the 100, which form a complete poem of this kind; and appended are some loose leaves seemingly belonging to another book, containing portions of a *Tevaram*, and *Manica-vasacar-padal*; both *Saiva* works of hymnology. This copy is in good preservation.

Both copies are entered in the Des. Catal. vol. 1. p. 245. Art. lxix.

25. *Cónri-ventan*, No. 170—Countermark 170.

This is another school-book, by the same authoress, following also the alphabetical order; but with sententious maxims a little longer, and a little more difficult: adapted to a child that has gone through the former one. This book was also called *Niti-chol*; but acquired the common term as above, from a modern and spurious invocation to *Ganesa*. A translation of it by Dr. John was printed in the Asiatic Researches.

Note.—The copy is complete in six small palm-leaves, written in a rude and school boy's hand: by consequence the measure of wisdom which it contains is concentrated.

It is entered in the Des. Catal. vol. 1. p. 245. Art. lxx.

26 *Cummi-pattu* a poem, No. 203—Countermark 158.

This is a fragment only of a work by *Vedanayak* of Tanjore, a Christian poet of considerable attainments, and eminence. He made extensive use of Scriptural subjects, put into a poetical form, which he was accustomed to recite in the public places at Tanjore, after the manner of native minstrels; *Homeric* also, if we may credit tradition. This work he addressed to his daughter, as "wise" or "well taught", ending his lines with that phrase, as many natives do with the sort of expletive *ammáné*, when addressed to some goddess, or lady of quality. In this poem there are severe strictures on idolatry, and idolatrous customs; with cautionary prohibitions against assimilation to them. From the beginning forwards there are 21 closely written palm-leaves; but much afterwards is wanting.

Note.—It is entered in Des. Catal. vol. 1. p. 224. Art. xxxiii, but so as to lead to the inference of its being an ethical production, mixed up with astrology.

27. *Deva-rayen-pala-padal* No. 190—Countermark 175.

28. same title, No. 157—Countermark 176.

These two manuscripts seem to be parts of two copies of the same composition; purporting, according to the title, to be various chants by *Deva-rayen*. Neither copy is complete, and in each one there is transposition, and confusion. The copy of one must have been made by a

Roman Catholic Christian, indicated by an expression at the beginning; and there is one *viruthom* or stanza, which declares the unity of the Supreme Being, and the vanity of idols, in such a manner, as evidently to be the composition of a Christian. The remainder, in both copies, as far as complete, is a sort of centum of verses extracted from various authors, and without much coherence; so as to wear rather the appearance of such kind of poetical extracts as are sometimes made in an album. Both copies seem to me quite useless; and are allowed to remain as I found them. They are entered in the Des. Cat. vol. 1. p. 226, art. xlvi, and are stated to contain "praises of *Vishnu* and *Siva*, and especially of the forms of the latter and his spouse worshipped at Madura, or *Sundaresvara* and *Minakshi-Ammal.*" This definition of the contents is very incorrect.

29. *Nannul Padaveyal,* Tamil etymology—No. 60—Countermark 211.

30. *Nannul,* a Tamil grammar—No. 61—Countermark 212.

The first of these manuscripts (or No. 60) is a part of the *Nannul,* being the chapter on etymology termed *padiveyal,* treating of words. It contains the original *sutras,* with the comment of *Sancara-Nama-sivaya* in *Shen*-Tamil, and another comment, or explanation of the comment, in *Codun*-Tamil, or the common dialect. This MS. is written on *Talipat* leaves (used in the extreme south); and is in good preservation.

The other M.S. (No. 61) is an imperfect copy of the same famous grammatical work by *Pavanandi,* abridged from the *Tolcapiyam,* as the latter is said to have been abridged from a still larger work of *Agastya.* The *Nannul* had three explanatory commentators; the comment in this MS. is that by *Sancara-Nama-sivaya Pulavan* alone. The MS. is however very deficient; at the beginning it wants the preface, the two first chapters, or sections, and a small part of the third at its commencement. Part of the 4th section, at the end, is wanting; and all the remainder, what there is of the contents is on orthography only. The leaves of the book are not of equal size; and seem like fragments of two books put together; being a fragment still. The leaves are of the broad kind common only in the extreme south of the peninsula. They are in tolerably good condition.

Note.—The two copies are entered in Des. Cat. vol. 1, p. 247, art. 2. —It will be seen from what precedes that if both MSS. were put together they would not form a complete copy of the entire work.

31. *Tonnul-vilacam,* a grammar of rhetoric, No. 62—Countermark 213.

This is a work of high reputation by *Viramamuni,* or *Beschi,* a Roman Catholic Missionary of the early part of the 17th century; whose philological works stand quite apart from those of any other European writer. He had many learned natives to assist him. He was, however, beyond all question, the most distinguished Tamil scholar of his age. This work is a grammar of the *Shen*-Tamil inclusive of prosody, tropes and rhetorical embellishments. It was translated by Mr. Babington of the Madras Civil Service; and is still a standard work for reference.

This copy wants five palm leaves, of the index only, at the beginning; the remainder is complete. The leaves and writing are quite fresh in their appearance: and remain undamaged.

Note.—It is entered in Des. Cat. vol. 1, p. 218, art. 3.

32. *Chitambara Agradi* No. 66—Countermark 224.

This manuscript is a vocabulary (termed *agradi* or *nigandu*) of the Tamil language, by *Revana Siddhar* of *Chillambram.* It is in *Sutras* or in brief verses, and does not extend the alphabetical order of arrangement beyond the first letter; under which order simply the words are arranged, and the meaning or meanings, given. It is a much more brief, and simple, composition, than the *Mandala purush-nigandu*; but better adapted for memory, or as a manual. The copy is complete, of recent hand-writing, and in good preservation.

It is briefly entered in Des. Cat. vol. 1, p. 252, art. viii.

33. *Hari-Vilakam* hymns to *Siva.*

34. *Agastya-nyanam,* the wisdom of *Agastya.*

These works were found tied up together with a few pages of the *Navya-sastra,* which last pages were discovered to be wanting in that manuscript itself, and being restored to the proper place completed it. Perhaps the whole originally formed one book; since, in size and appearance, they correspond.

The *Hari-vilakam* is mystical poetry, of a kind needing no special abstract.

Agastya-nyanam, is, I am persuaded, a literary forgery, the work of some *Uttra Saiva* devotee, ascribing his own composition to *Agastya.* In the work of creation the order of the *Trimurti* is *Siva, Brahma, Vishnu*; in the manner of the modern *Uttra Saivas* of the Peninsula. Very strong and pointed condemnation is given of the *Vedas*, as well as of the *Ramayana, Bharatam*, and in short all *Vaish-nava* books, or those that are consonant to the more universally received *Hindu* system. The writer professes to give an account of his own birth as being *Agastya*, and mentions some of his works. Some moral sentences are mingled up with the other matter. I am not sure that it is not a forgery of the days of Robert de Nobili under an *Uttra Saiva* veil ; but, at all events the name of *Agastya* is a *nom de guerre*, to serve some special purpose. The *Hari-vilakam* is a little injured by insects, the rest of the book is in very good order, and complete.

See Des. Cat. vol. i. p. 228, art. liii.

35. *Sivapracasica*, a work on austerity, or self-control, No. 130. —Countermark 57.

This poem is of the kind treating of the *tatva* system or different parts, properties and regulation, both of the material, and immaterial, portions of the human body. The allegorical description of the body, as a city ; having gates, and a resident within, or the soul, is contained herein. The same allegory is found in the *Bhagavatam*, ascribed to *Nareda*; and also in other distinct productions, of which the present is one. The body is divided into five elements, and five qualities of the mind are specified; to the varied union, or combination of which elements, certain operations, both corporeal and mental, are ascribed. Absolute renunciation of all earthly attachments, that to father or mother being included, is taught. Severe penance, and personal subjugation are enjoined. The worship of *Vishnu* is to be rejected ; and the system of *Siva* alone ought to be observed. The work bears the name of the author *Sivapracasica* (one having the splendour of *Siva*), and the contents are sufficient to indicate his having been a *Pandaram* (or ascetic) of the *Saiva*-order. There is a monasterium of that class at Madura, another at *Mailapur*, and others in different places.

Note.—The MS. is complete, and only a little injured, at present

not sufficient to call for restoration ; but it will require to be occasionally looked at for better preservation.

It is entered in Des. Cat. vol. i. p. 231, art. lvii.

36. *Aruna-giri-nat-ha-tiru-pugerzh* or hymnology, No. 138—Countermark 203.

37. Same title, ——— No. 139—Countermark 179.

38. Same title, ——— No. 140—Countermark 66.

39. Same title, ——— No. 142—Countermark 1078.

No. 138 contains 106 stanzas, and is complete.

The MS is old, and the leaves are considerably damaged by insects. No. 139 contains 50 stanzas, and remains incomplete at the end. It is fresh and in good condition. No. 140, contains 55 stanzas, not finished : it is old, and damaged by the breaking of one or two leaves at the beginning, and at the end. (It is supposed from the Nos. that there should be another copy : but this has not been met with).

No. 142 contains 84 stanzas, wants the 33d and 40th leaves, and does not finish at the end. The palm-leaves are comparatively fresh ; but damaged by insects in several places.

These manuscripts are portions only of one great work ; reputed to contain in all sixteen thousand stanzas, of the kind termed *Viruttam* by *Aruna-giri-nat-ha*, so called after the god at *Trinomali*. His name forms parts of the above title, and the words *tiru-purgerzh* mean sacred panegyric. This panegyric is contained in a series of hymnology ; addressed to a form of *Subrahmanya*, worshipped at *Tirtani*, near Madras.

Note.—The title appears in Des. Cat. vol. i. p. 225, art. xxxviii ; but only one copy seems to be therein entered.

40. *Tiruvachacam Hymnology* by *Manica Vasacar*, No. 103—Countermark 161.

41. Same title ——— No. 104—Countermark 162.

42. Ibid. ——— No. 105—Countermark 163.

43. Ibid. ——— No. 106—Countermark wanting.

These are copies of a collection of panegyrical stanzas by *Manicavasacar* whose story is narrated in the *Vadur*, and Madura *St'halapuranas*. After relinquishing his office of minister of state to the Madura king, and undergoing severe treatment, as narrated in those legends, he became a devotee of *Siva* : and, exclusive of disputing with the *Bauddhists*, he wandered about in the manner of ascetic minstrels, such as *Appar*, *Sundarar* and others, and composed brief panegyrics of different forms, or emblems, of *Siva*, worshipped at different places. The entire amount of such chants was fifty-one ; which chants (consisting at least of 10 stanzas, but generally one, two, or three more) make up a total of six hundred and sixty stanzas of the kind termed *viruttam*, with a few of the plainer kind termed *agaval*. For a further account of the work see abstract of the *Vadur St'halapuranam*.

No. 103 is complete. There are added 27 chants from the *Tevaram*, a similar collection by *Appar*, *Sundarar*, and *Sampantar*. The whole forms a small sized pocket volume, which, though rather old, is quite uninjured.

No. 104 is complete. It also contains a portion of the *Tevaram*, not complete. This small book is old, but nevertheless in good preservation ; save only a little wear at the edges.

No. 105. This copy wants seven chants, in different places. Forty eight stanzas are appended of a polemic poem against the *Bauddhas*, not complete. This manuscript is fresh, slightly punctured by insects, but to a trivial degree.

No. 106 has 38 chants wanting. It has two appendages, being fragments of poems of the *Venpa* kind, without title ; but containing praises of *Siva*.

These four copies are entered, with a brief mention of contents, in the Des. Catal. vol 1. p. 224. Art. xxxv.

44. *Vriddhachala Puranam*, No. 21—Countermark 30.

This copy is in verse only, and is complete. It is generally in good order ; but with an exception of five leaves in the middle, which have been restored, in order to preserve the manuscript legible and entire.

45. Same title, No. 22—Countermark 31.

This copy contains the original verse, with a prose explanation. It is in good preservation; except four leaves, near the middle, which have been restored. It is now complete; having had two sections, before wanting, added to it from the next copy.

Same title, No. 23—Countermark 32.

This copy is in verse, and prose; but is very incomplete; wanting five *sargas*, or sections, from No. 14 to 18 inclusive. What remains is without defect; and, being apparently of recent writing, it is in perfectly good preservation. It enabled me to complete the preceding copy.

Another book, having the same title on the envelope, was found to be a copy of the *Vadur St'hala-puránam*. Five copies of the *Vriddha-chala-puranam* are mentioned in the Des. Catalogue. The fifth is not now in the collection.

The following is an abstract of the contents.

1. The prefatory section. Invocations to deities, and to *Appar*, *Sundarar*, and other *Saiva* poets. It is given as narrated by *Suta-rishi*, who received it from *Sveta-muni*; he from *Vyasi*; the latter from *Subrahmanya*, who heard *Siva* relate it to *Uma*.

2. The *giri-sarga*, or section concerning the hill, narrated by *Aran* or *Siva* to *Uma*. Though the legend is unknown to *Brahma*, or *Vishnu*, yet there is a propriety in relating it to *Uma* though young, from her being mountain born. The pre-eminence of the hill, above all other hills, is asserted: so that even thinking of it will remove evil, produce good, and lead to beatification; which, by means of this hill, even the most stupid of people may acquire. Its excellence arises from its being a copy of the form of *Siva*.

3. Concerning the place; narrated by *Natha-sauma-muni* to his wife, named *Anavati*. It relates to a sacred pool for bathing named *Tiru-amrita-kunram*, formed by the *Mutta-nadi* river. Bathing therein accompanied with certain observances removes the crimes of ingratitude, theft, drinking ardent spirits, killing cows, or *Brahmans*, coveting the wife of a *Brahman*, or a neighbour. If dogs, jackals, or such like animals, die at this place they will attain to *Siva's* world; being taught instruction, while dandled in his lap. The ills, or crimes, done by children will be pardoned even as those of grown up people. The names of the seven great *rishis* are mentioned, who obtained gifts, according to their desire at this place.

4. This section relates to the high value and excellence of the *Muttà-*

nadi river. The merit of bathing in it is related. For example, if it be only seen, by the favour of the god, sin will be removed. To bathe in it is equal to the merit of an *asvamedha* sacrifice, and to remain in it during one bright half of the natural day ensures beatification. *Agastya* and several others by bathing therein, acquired sanctity.

5. *Isa* enquires of *Uma* concerning the shrine. A special eclipse is adverted to, at which time the *vimana* appeared, with various marvellous accompaniments. The benefits of worshipping thereat are narrated.

6. The section of *Viba-chittu*. One of *Cuvera's* precious jewels, was picked up by a particular kind of bird (mistaking it for its food) and carried to the top of a tree; when the bird dropped it on the head of a person named *Viba-chittu*, doing penance. He did not know what to do with it; and, while wandering about on the mountain, an aerial voice directed him to deposit the gem in a *vanni*-tree, and then to go and receive instruction from *Romasa rishi*. He did so, and the *rishi*, by his merit formed a *Calpa-vricsha*, or tree of plenty; yielding every thing desired. In consequence *Viba-chittu* had a golden image made for the shrine with all other needful appurtenances: and ultimately "attained the feet of the god," or was beatified.

7. The *tiru-náda* section, narrated by *Brahma*, and downward through various celestials. It relates to a particular locality, on the hill where birds are fed termed *tiru-amrita kunram*; where also *Siva* condescended personally to make an appearance, and to receive adoration.

8. The section of *Agastya*. This relates to *Agastya's* journey to the south; being resisted by the *Vindhya* mountain, he trampled on and lowered it; he afterwards met with *Váthan* and *Vil-vathan* who were accustomed to kill and eat travellers when passing by: he denounced his anger on them and destroyed them. He then proceeded to *Vriddhachala*, where he bathed; and, seeking pardon, for having killed the said cannibals, *Siva* appeared, granted his request, and then vanished.

9. The *Calinga* section. A *Calinga* king, did not pay proper respect to *Romaca maha rishi*, but mocked him; in consequence of which the *rishi* denounced on him the doom of becoming an evil-spirit-possessed wanderer. He embraced the sage's feet, demanding when and where, the crime would be expiated, and was told it would be at *Vriddhachala*. He accordingly became possessed with an ill-spirit, and roaming about, came to *Vriddhachala*, where bathing in the *Mutta-nadi* he was relieved. As a moral, a caution is added not to mock sages, who are performing penance.

10. The section on removing the evils of the *Cali-yuga.* The sages enquired of *Suta-rishi,* the magnificence of the lord of *Vriddhachalam,* and he answered by saying that *Sanat-cumara,* and others, went to *Brahma* on *Maha-meru,* who enquired the reason of their sadness. In reply a pathetic detail was given of the poverty, and other evils of the *Cali-yuga* ; in which the kings were *Sudras,* the sacred beads indiscriminately worn by all, and many other ills ; on which a petition was founded that *Brahma* would form a shrine to remove them all. The request was answered by the means of the shrine at *Tiru-amrita-kunram,* which removes or sets aside all the evils of the degenerate age.

11. The *Sweta* section. *Sweta* was a king of the *Curu* race, who ruled over many persons with the integrity of a *Chacraverti,* till losing his wife by death, he became desirous to renounce the world, and to acquire as quickly as possible instruction as to the means of obtaining final happiness. In pursuit of his object, he went on pilgrimage, and among other places to the shrine of *Jambukesvara* at *Tiruvanica.* In an interview with *Agastya,* the latter stated the advantage he had acquired by doing homage at *Vriddhachala* ; and recommended his pursuing the same course ; which advice he followed ; and, in consequence *Siva* appeared to him, and bestowed on him the gift, and happiness, which he desired.

12. The section of devout worshippers. The benefit of affectionate worship is illustrated by reference to a *Chetti* who had four sons ; three of whom were liberal and charitable, and were beatified, at other fanes specified ; the fourth was of a vicious disposition, and conduct, in consequence of which, and of his slighting the *Brahmans,* he brought on himself the visitation of *Brahma-hatti.* When suffering under this infliction he met with a *Brahman,* and asked how his disorder could be removed, who directed him to be liberal in donations to the shrine at *Vriddhachala.* He accordingly became extremely munificent, in providing butter-oil for the anointing of the image, and for lights, and in gifts to the *Brahmans* and servants of the fane. By persevering in this course, in the space of a year, he was entirely relieved of his disorder, and obtained consolation. The benefit of devout homage at this shrine is hereby apparent.

13. The *Siva-puja* section. *Siva* replies to *Uma's* enquiries. This section relates to various symbols of *Siva,* and to plants, and herbs, used in the ritual ceremonies of *Siva's* worship.

14. The *Vibuthi*-section. Declared by *Siva,* to the four orders of *Sanniyasi, Vanaprast'ha, Brahmachari* and *Grihast'ha.* It relates to the formation, and use, of the sacred ashes used by *Saivas,* and the parts

of the body to which the same ought to be applied. This being done the very person of god (*sacshat-kadaord*) resides in the wearer. Any *Chandalas* who ridicule the use of these ashes will go to *Naraca*. The eulogy of the *Saiva* worship is added.

15. The *rudracsha* section, narrated by *Nat'ha Sauma* to *Anavati*. The different varieties of beads termed *rudracsha* are specified, as appropriately belonging to the *brahmanical*, kingly, mercantile, and servile, classes; and the advantage of wearing them is declared. (Perhaps the origin of their use may have been a simple device to distinguish the different classes, or orders, of men).

16. The *Kirti* section. The same person relates, to the same individual, the fame of this place; stating that though beatification is of difficult attainment, generally speaking in the *Cali-yuga*, yet that it may be easily attained at *Vriddhachala*. If any one at this place, repeat the name of *Siva* three times, at the mention of the first *Siva* will appear, and give what is wanted; at the mention of the second, there will be a surplus of merit; and the third will secure his residence within the worshipper. Hence even the thousand tongues of *Adi-seshan* could not tell all the excellence, and fame, of this place.

17. The section of the bullock mountain, narrated by the same to the same. *Parviti* performed homage to a particular image, until *Siva* appeared, and asked what gift she desired; to which the reply was, that she wished a shrine to be formed at the same locality, to be called after *Nandi*, his bullock vehicle, and the request was conceded. At this place *Vishnu, Brahma*, and the celestials did homage, and obtained gifts. Many *rishis* did the same.

18. The section of *Sashi-vanna*. *Siva* declares to *Vishnu*, the excellence of his (*Siva's*) votaries. *Sashi-vanna* was the son of a *Brahman*, but one who despised *Siva*, the *Vedas*, the *Brahmans*, and true equity. At the same time he lived a bad life; so that many of his family went to *Naraca*, and he became a *Chandala*, afflicted with leprosy. In consequence he performed penance; and enquiring how to get his disease removed, he was directed to the above mentioned bullock-mountain-shrine, whither he proceeded; became entirely cured; and obtained beatification, both for himself, and for his relatives, who before had gone to *Naraca*. Hence the efficacy of that shrine is deduced, by way of inference.

It is added, in conclusion, that whosoever reads, hears, or copies out this *Saiva-puranam* will obtain happiness, learning and beatification.

The end of the *Vriddhachala-puranam*.

Note.—To any who has read through the preceding abstract it will be

superfluous for me to suggest any remarks. The locality of *Vriddha-chala* (old-hill) I understand to be intermediate between *Trinomali* and the *Caveri*-river, that is to Verdachellum in the Carnatic.

The MS. is entered in Des. Cat. vol. 1, p. 169, art. xviii.

47. *Vadur St'hala-puranam,* No. 19—Countermark 28.

48. Another copy, No. 36—Countermark 81.

49. Ibid. No. 37—Countermark 82.

50. Ibid. No. 38—Countermark 83.

The first of these copies was erroneously labelled as a copy of the *Vriddhachala-puranam.* It is a very defective manuscript, wanting four *sargas,* out of the eight, of which the work properly consists. Of the remaining four sections the deficiencies are 95 stanzas from the cooly section, 70 stanzas from the fane-section, and 99 from the *Baud-dha*-section, only one section is complete. The composition is in verse, with a prose explanation or commentary. [There remains 126 palm-leaves a little old in appearance ; but quite uninjured as to condition.

No. 36 is apparently quite a recent copy : it is also complete in 289 palm-leaves, containing 525 stanzas ; each stanza being accompanied with a prose explanation.

No. 37 has a deficiency of 10 stanzas in the 2d section, 1 stanza in the 3d section, 4 stanzas in the 7th section, and 1 stanza in the 8th section, being 16 stanzas in all, leaving the remainder complete, untouched by insects, and in perfect preservation.

No. 38 has a deficiency of 20 stanzas in the section about the horses : the remainder is complete. The copy is old; but, with a few slight exceptions in very good preservation.

No. 39 being complete, nothing needs to be done, as to restoring the remaining copies. The following is an abstract of the contents :

1. The usual invocation, and eulogistic stanzas.

2. The *mantri* section. It narrates the parentage and education of *Mànica-vàsacar*, at *Vadur*, in the *Pándiya* kingdom. He was a *Brahman ;* and received the sacerdotal string at 14 years of age. Being of

superior intellectual qualifications he was chosen by the *Pándiyan* king as *mantri*, or minister of state; in which capacity he conducted the affairs of the kingdom with great equity. He received 40 crores (of money) from the king with an order to purchase horses; and on his journey, with that object in view, at *Tiru-perunturai* was fascinated by the god, *Siva* as *Jangama-svami*, chanting mystic songs. He went near with his whole retinue, and listened with great delight.

3. The *Tiru-perunturai* section. So far *Manica-vasacar*, was merely a hearer at a distance; but he was now brought specially into the presence of the god, and was introduced to the said *Siva*, seated on a throne. *Siva* condescended to teach him the mystic sense of the *agamas*, and various *Saiva formula;* in consequence of which his eye of ignorance departed, and he was spiritually illumined. When fully taught, the god asked what present (as customary) he intended to pay as the price of his initiation to disciple-ship; when he laid the whole 40 crores, received as above, as an offering at the feet of the god, who was greatly rejoiced. While *Manica-vasacar* was thus engaged, his attendants wondered what was become of him; and seeking him out, reminded him of the king's business, and the need of attending to it. He was absorbed in contemplation, and paid no attention to them: on their becoming more urgent, he opened his eyes, asked them who they were, and who was the *Pandiyan* king of whom they spoke; adding that they did not appear to him to be votaries of *Siva*, and told them to depart. They accordingly went, and reported the matter, to the king; who, being much incensed, wrote a severe letter and sent it to his lethargic minister. The latter, on receiving it, appealed to the god; who directed him to send word, that on such a day of such a month, horses would come. The king enquired if there was any appearance of horses at *Perunturai;* and being answered in the negative, he sent peons, with directions to seize and bring the minister to him; which was done. *Manica-vasacar* was put in irons, and cast into prison for several days; treatment which he endured with composure; and occupied himself in chanting the praises of *Siva*.

4. Horses-section. According to the word which *Siva* had directed to be sent, the said god, assembled all the jackals throughout the country, and turning them into horses, caused the celestials, under human forms, to mount them as riders, while he himself assumed the form of the king of *Ariya-desam*,* whence the horses were expected to be procured; and, on the day appointed, the whole cavalcade came to the town of the *Pandiyan* king. The latter was extremely well satisfi-

* Part of Travancore.

ed; had the qualities of the horses examined; and, finding them to be superior, appointed their location. While at the same time he released his minister from durance vile, who went to his house, and sang the praises of *Siva.* During the night by the power of *Chocapa* (the form of *Siva* at Madura) the horses re-assumed their natural forms as jackals; and greatly disturbed the whole town. The king, doubly incensed, and greatly disappointed, commanded the seizure of *Manica-vasacar,* and his being put to a certain species of torture in the dry bed of the *Vaigai* river. This torture consisted in his being stretched out on the sand with a heavy black stone on his body, to keep him down; suffering from the burning sun, and scorching sand, by day, and cold by night; until the 40 crores should be re-imbursed. *Manica-vasacar* endured with fortitude, invoking the aid of *Siva.*

5. The Cooly-section. The god knowing the sufferings of his votary directed *Ganga Bhavani,* to go down to earth, and relieve his distress. Accordingly *Ganga Bhavani* came down; and, filling the channel of the *Vaigai,* caused an inundation extending even to the walls of the fane. The king directed the customary offerings to be paid to *Ganga*; but, on throwing these into the water, the inundation swelled still higher, threatening destruction to the whole town. The king was at a loss as to what want of equity, on his part, was the cause; but directed repairs of the damages, and of the banks of the river. Every person in the town had an allotted portion of work to do. A poor widow who had no son, and lived by making and selling balls of rice-flour, represented, to the god in the fane, her inability to do her own portion of work. Soon after the god himself came with the appearance, and usual implements of a cooly, crying out for work; and was engaged by the widow as her cooly. On his enquiring about wages, she replied that she could only pay in the commodity by the making and selling of which she gained her subsistence. He took a portion in advance; and on being shewn by the widow her share of work, threw carelessly half a large hoe-full of earth into his basket: and then, dancing about as he proceeded, the widow suspected a bad bargain; but he told her to go home, and he would finish the work. Instead of doing so he laid down to repose under a tree. The king, coming to inspect the progress of the repairs, found the widow's portion neglected, and was pointed to her cooly asleep under a tree. Arousing the sleeper, the king prepared to give him a blow with a rattan; seeing which the god protected his left side, and received the blow on the right; a blow which was felt by the whole creation. *Manica-vasacar* startled at receiving a blow on the side, enquired into the circumstance, and discovered it to be an amusement of *Siva,* who had

disappeared. *Manica-vasacar* went to *Peruntara*, and, at his request, the god appeared; taught both him and the king some lessons; and directed that *Manica-vasacar* should be employed in disputing with the *Bauddhas*.

6. The fane-section. *Manica-vasacar*, again at *Perun-turaiyur*, represented all his sufferings to the god, and received various instructions from *Siva*. The god then assembled all his votaries, and told them that he was about to return to *Cailasa*, that after his doing so, a fire would appear, into which all his followers, with the sole exception of *Manica-vasacar*, were to cast themselves; and on their doing so, their beatification would be assured. On the departure of *Siva* according to the preceding declaration, *Manica-vasacar* fell on the ground, on the spot where the god had been, and wept greatly. Soon after a large fire appeared, into which the *Saiva* votaries cast themselves, as they had been told to do. *Manica-vasacar* left the place, and set out on pilgrimage to the various *Saiva*-shrines in the southern part of the peninsula, such as Conjeveram and others; at each of which shrines he composed, and chanted, hymns in praise of its local *numen* (the assemblage now forming the *Tiruvachacam*). He subsequently returned to the neighbourhood of *Chillambram*; where he constructed for himself a hut, or sort of nest, in a tree. Here he continued rendering homage to *Siva*.

7. The *Baudha*-section. *Manica-vasacar* had studied, and was deeply versed in the *Tatva* system (relative to the corporeal and mental qualities of human nature, their relations, union, and consequences); and being now disposed to visit *Irza-desam* (Ceylon) he proceeded thither, and every where proclaimed the name of *Siva*, under a particular title, by which he is known at *Chillambram*. In consequence of hearing so much about this name, the king sent for *Munica-vasacar* and desired to know what it meant; when it was explained to mean the musical sounds proceeding from the shrine of *Siva* at *Chillambram*. The king of *Irza-desam*, in consequence announced his intention of sending a colony of his own people, with sacerdotal attendants, to that place, to construct there a shrine of the god worshipped by himself, that is, *Buddha*. The colony was accordingly sent, and the fane built. But the three thousand votaries of *Siva* dwelling in the *Tilli* wilderness, became alarmed at this innovation; and going to the new settlers, told them to depart. As they refused to do so, information on the subject was sent to the *Chola* king of the country. Ultimately both the king of *Irza-nad*, and the *Chola* king, came to *Chillambram*; when it was agreed on to hold a public disputation. In the interim, the god

appeared to his votaries; and told them not to engage in the discussion, since they would not be able to compete with their opponents; but instructed them to trust the entire management of the question to *Manica-vasacar*. In consequence *Manica-vasacar*, was put in the seat of honour, and the *Bauddhas* directed the discussion against him, using the *Tatva* system; and were greatly surprised that they could not overcome him therein. Seeing this state of the case the *Irza* king told *Manica-vasacar* that he had a daughter born dumb, and if *Manica-vasacar* could make her speak, then he and all his people would adopt the *Saiva* mark, and the *Saiva* way. The dumb girl was accordingly brought forward, and as *Manica-vasacar* gave, or restored, the power of speech, the king became a *Saiva*, together with his followers, and paid homage at the *Chillambram* shrine.

8. The sacred feet-obtaining section (or the beatification). The god assumed the form and appearance of a *Brahman* bearing writing materials, and an iron-pen in his hand; in which shape he came to *Manica-vasacar*, who enquired whence he was. The apparent *Brahman* said he came from the *Pandiya* kingdom, and as the fame of *Manica-vasacar's* chants in the *Tiru-vachacam* was now every where spread abroad, it was his (the *Brahman's*) desire to be permitted to write them down from the composer's own dictation. *Manica-vasacar* consented, and the chants were committed to writing, by the *Brahman;* who, having completed the whole, disappeared, together with the book. *Manica-vasacar* sought him every where in vain; and now discovering that it was an illusive form of the god, he wept over his departure. The book was however taken by the god: and deposited on one of the five lettered steps, immediately in front of the shrine. The following morning, when the attendants on the fane opened the doors, they were surprised at finding a book laid on one of the sacred steps, and paid it divine honours. On looking it through, it was found to bear the autograph signature of *Tiru-ambalan*, or the local *numen*, and it was respectfully carried to *Manica-vasacar* with the request that he would explain its meaning. To this he readily consented; and then, going with them to the presence of the image in the shrine, he there unfolded the meaning, and explained, that the said image formed its sum and substance. Having completed the exposition, a flame appeared enveloping the place, being the emanation, or effluence of the divine essence, and at the same time the soul of *Manica-vasacar*, quitted his body,and became united with the said divine essence: forming the union and identification with the divine nature, which is regarded as the highest degree of beatification. Here the *purana* ends.

Remark.—There is a close co-incidence between this *puranam*, and the Madura local legend, as far as to the end of the fourth section of this one. The Madura legend refers to the present document for the rest; briefly mentioning that *Manica-vasacar* disputed with the *Bauddhas* at *Chillambram*; and there became united with the essence of the deity. There is, I think, clear evidence, in this document, that the Madura country had not adopted the *Saiva* religion in the time of *Manica-vasacar*. The 7th section is of some historical importance; and will be of service in its place. The account of the *Tiru-vachacam* is, at the least, curious. A native proverb declares that the person who is not affected by the tale and writings of *Manica-vasacar* will be affected by nothing. This work, at the commencement, that is, in the 1st section, is stated to be the composition of *Kadavul-nayanár*.

Note.—The three MSS. Nos. 36, 37, 38, are entered in Des. Catal. vol. I. p. 201. Art. xvi with a brief account of the subject; having only one or two apparent, and slight inaccuracies.

b. Manuscript Books.

Manuscript book No. 1—Countermark 47.

Palani-puranam. The legend of Pyney.

Of this large manuscript, thirteen sections were abstracted in my last report. What follows is a continuation.

Section 14. The narrative concerning *Brahmendiran.* The *rishi* named *Angirasa* had a son who was named *Agni-tama,* a name which was afterwards changed to *Brahmendiran.* He was carefully taught; and, by his own application, became well read. After making proficiency in study, he proceeded on a pilgrimage to the whole of the *Saiva* fanes, and after visiting other places he came with a retinue of disciples to *Tiruvavanankudi* (another name of Pyney). The followers of *Brahmendiran,* greatly approved of the locality; and recommended the fixing a residence there. The whole body, by consequence, continued at that place, doing penance. At length the local deity, *Subrahmanya,* appeared; desiring to know what gift or reward they required; and, at their request, gave to the whole of them beatification.

Remark.—This section is of considerable consequence; inasmuch as it clearly marks the first immigration of Brahmans, settling at Pyney: in the same way as the first location of another Brahman colony at Chillambram was before noted. Vide 3d Report.

Section 15. The narrative concerning *Nitya-nat'ha.* This account refers to the period of the *Treta-yuga. Nitya-nat'ha* was a son of *Nala-raja.* He was powerful and wise. Proceeding on pilgrimage he came to the *Congu-nad* (modern Coimbatore in which Pyney was situated). He visited seven *Saiva*-fanes in that country. He built a town which was called *Raja-raja-puram.* Afterwards he proceeded to *Tiruvava-nankudi*; and there performed penance. *Subrahmanya* appeared; and, being praised by his votary, asked what gift, or reward, the latter required; who answered that he desired to reach the sacred feet (obtain beatification) without the pain of future births. The said god then instructed him in the *asktanga-yoga* (or eight-membered-meditation; that is *anima, makima, karima, lakima,* &c. Vide Oriental Historical MSS. vol. 1, p. 128); and assured him that if he practised these various forms of contemplation, he would attain final beatitude. As so many persons performed penance at this place, it acquired the appellation of *Yoga-vanam* or the site of contemplation.

Remark.—This section indicates the ingress of the military tribe to the extreme south; while a reference back to section 10 would seem to imply that the *Chera* race was aboriginal, and not *Hindu.* Comparing section 15 with section 14, there is visible a delicate reserve of the privileges of *Brahmans* above *Cshetriyas*; inasmuch as the former were beatified at once; but the latter after instruction and study.

Section 16. The story of *Chonna-cuttan.*

There dwelt in the *Congu* country a person who was called *Chonna-cuttan,* with his wife named *Kesai.* He worshipped both *Siva* and *Vishnu*; and his wife paid homage to *Lacshmi,* and *Narrayana. Perumal* (*Vishnu*) came to this beautiful country. The said pair besought from him the gift of a child. He replied that if a child were granted, it would soon die. They answered that their desires would be satisfied, if they might see their own child, and afterwards if needful it might go, they would relinquish it. *Vishnu* thereupon directed the chank (or conch), in his hand to be born as a child; and at the end of five years to return to him. It was accordingly born, and reared by its parents, as aforesaid, very carefully. They in acknowledgment bestowed many ornaments both on the *Saiva* and *Vaishnava* fanes. The child did well and grew, until its fifth year came. It was accustomed to rove about; playing in the sacred buildings and pools of water. One day when sporting in the *Camadhena-tirt'ha,* or pool so called, the remembrance of its former state revived; and it in consequence returned, and re-entered the conch of *Vishnu.* A report was brought to the parents

that their child had fallen into the pond. They were exceedingly grieved; went to the place, and carefully sought for the body; which however was not to be found. They roamed about seeking it; being beyond measure distressed at their loss. They both thought of casting themselves into the fire; so severe was their anguish. *Subrahmanya* at length appeared to them, in the likeness of a child. They were rejoiced, as he seemed to be their own child. They took him up in their arms, and fondled him; when the seeming child re-assumed his usual appearance, having six heads, and twelve arms. He told them that their child had been a gift of *Vishnu,* and had resumed its own form, as the chank of that deified personification; adding that from regard to them, and with a view to alleviate their sorrow, he had appeared to convey to them this annunciation. He further stated to them that there was no difference between himself, and the said *Perumal,* or *Vishnu.*

Section 17. The legend of *Vasumantan.*

Vasumantan was a king who resided at *Deva-puram.* A *rishi* recommended him to do penance at this place, where many others were so employed. An account of his penance is given. In a former state, or birth, he was of the *brahmanical* order, and a descendant of *Casyapa;* but in consequence of dwelling with a *Sudra* woman, he lost his caste, and sank to the level of a *Sudra.* The effect of his penance was, by means of the homage paid to *Subrahmanya,* to assure his regaining the rank of a Brahman, in a following birth, with all connected privileges.

Section 18. Account of the six faced river. *Subrahmanya,* looking from *Varáha-giri,* saw another hill; and was told by a Brahman that six torrents ran down it, uniting to form a river at the base. As the hill had six rivulets corresponding with his six faces (*Aru-muchan* "the six faced one" is a title of *Subrahmanya*), he granted to the river below this, the peculiar quality, or virtue, of washing away the guilt of every crime. In consequence of this especial privilege having been bestowed, the fane, which is situated on the said hill at *Tiru-vavanankudi,* is a superior place; and final beatification is there of certain attainment. *Subrahmanya* is represented as taking occasion to specify six places where he is worshipped, as being of especial consequence. These are *Tiru-paran-Kunram—Alavayi-carai—Tiru-chendur—Tiru-vavanam-kudi—Tiru-varacam* and *Para-mutal-choli:* the latter being, as I am informed, another epithet of Pyney.

Note.—The abstract of the foregoing five sections may suffice, for the present, in continuation. The remaining five sections would properly

require to be specified somewhat more fully: the doing of which would entrench too much on other matter, which I am anxious to pass out of hand. An appropriate place for the remainder of the foregoing local *puranam*, may perhaps be found in a following report.

Manuscript book, No. 17—Countermark 910.

This document is entirely occupied with an account of different tribes, and orders of men in the *Malayalam* country. Fifteen kinds of Brahmans are specified; the *Namburi* class being at the head. Sixteen subordinate orders, or tribes, are detailed; one of them being the *Cshetriya*, or kingly caste, and another the *Samanda rajas*, or chiefs, at Calicut. Of several of the different classes, notices have appeared in the shape of abstracts from papers in the *Malayalam* languages; yet not to such an extent as to supersede the fuller details contained in this volume. They are many of them very minute, extending to a specification of distinctive modes of dress, and like details. The distance to be observed by each tribe in approaching another, is stated. An abstract of such matters would be in a manner impossible. A translation might be curious; and to some degree interesting; but it might be deferred until other documents had been previously disposed of. This book is of small size, and wholly written on stout China paper; the ink being very legible. The hand-writing is peculiar; being the Tamil writing of a native of Malayalam. The book has escaped injury remarkably well: the paste of the covers has attracted insects, but their work of destruction seems to have been interrupted; and, with common care, the book will last, as it is, for some time to come.

Manuscript book, No. 52—Countermark 1021.

According to the English label this book originally contained copies of inscriptions from the south of India. The number assists in referring to the Des. Catal. vol. 2, p. cxxvi: from which it appears to have consisted of 126 copies of inscriptions on stone and copper from Coimbatore, Caroor, and *Dharapuram*. The book, as received by me, has only the covers; all the inside being wanting. How this loss occurred I cannot say, but I return the envelope simply as received.

Manuscript book No. 50—Countermark 1019.

Section 5. Several leaves intended to have been filled with copies of inscriptions, from various places in the Jaghire, have been left blank, in the said book.

Section 6. Copies of inscriptions at *Tiru Karz-kunram*, and other neighbouring places.

1. Commemorates an extensive grant of land, with reservoirs, &c. to the image of the above fane, termed *Bhakta-varchatta-svámi*, and also a gift of 250 pieces of money, arising from the sale of a village, made in the time of *Hari-hara-rayer*, but without date of year, and signed by the donors.

2. Gift by *Canda-rayen* of 1360 *fanams*, to the said fane attested by witnesses, and not to be reclaimed. The astronomical day specified; but no date of year.

3. Gift by the son of *Canda-rayen* of 1560 *fanams*, inalienably bestowed on the said fane: astronomical date of cycle given, and Friday specified.

4. Gift by weavers of 70 *fanams*, date as before.

5. Donation by traders of a proportion of their profits; being 2 per cent. on some articles and 3 per cent. on others, to the said fane. No date of year.

6. Dated in the 42d year of *Kulottunga Chola*; a long strain of poetical panegyric being prefixed. It commemorates the gift of a tax on revenue proceeds, for the benefit of the said fane.

7. Dated in the 25th year of *Kulottunga Cholan*. Gift of 700 current *cash* (probably gold cash) for the purchase of a village, presented to the fane, to maintain a perpetual light, during their own time, and that of their latest posterity; by two brothers, landed proprietors in the neighbourhood of *Madurantacam*; attested by several witnesses.

8. Dated in the 33d year of *Kulottunga Cholan*. It commemorates no gift; but seems to be a record defining limits and privileges.

9. Gift of 22 cows to provide butter-oil, for the maintenance of lights in the fane, by persons who subscribe the deed of gift.

10. Dated in Sal. Sac. 1328, in the time of *Hari-hara Bukha-rayer*. Gift by him of land for the service of the above mentioned fane.

11. Dated also in Sal. Sac. 1328. Gift of land and of 60 gold pieces by *Bukha-rayer* to the fane.

12. Dated in Sal. Sac. 1320 in the time of *Deva-rayer* of the line of *Hari-hara Rayer*. Bestowment of land in free tenure to the fane.

13. Dated in the 13th year of *Vira Pandiya-dever*. Gift of land without any reserves to the fane,

14. Dated in the time of *Sri-vira Vijaya Bhupati-rayer* (all titular names), cycle year only mentioned. Gift of land, by a union of various classes of people specified, for the advantage of the fane.

15. Dated in Sal. Sac. 1330 in the time of *Bhupati-rayer*. Gift of 32 cows, &c. to the fane, for the supply of oil for lights to be maintained therein.

16. Dated in the 1st year of *Sambhura-dever*. Gift of 350 fanams for the service of the image in the same fane.

17. Dated in the time of *Deva-maha-rayer* son of *Vira-vijaya Bhupati-rayer*. Gift of the proceeds from the sale of these villages; amounting, in all, to 820 fanams (kind not specified); from persons subscribing their names.

18. Dated in the 21st year of *Tribhuvana-dever*. Gift of land for the service of the fane.

19. Dated in the 1st year of *Sundara Pandiya-dever*. Gift from several persons of the *Kón* tribe (bearing that affix to their names). Gift of cows, &c. to provide butter-oil for lights in the fane.

20. Dated in the 1st year of *Sundara Pandiya-dever*. Gift of a proportion of rice-grain, at the time of harvest, and 22 fanams, from four *Pandarams* to the fane.

21. Dated in the 1st year of *Sundara Pandiya-dever*. Gift of 67 fanams to the fane by certain persons, who subscribe their names.

22. Gift of 850 *fanams*, for the service of the fane; no date of year specified: incomplete at the end.

23. Dated in the 3d year of *Kulottunga Cholan*. Gift of land, to the fane.

24. Commemorates the building of a *Mantapa*, or porch, by *Canada rayen*, for the accommodation of all the *rishis*, and the 330 millions of celestials.

25. A fragment of a few words; of no connected meaning.

26. The same.

27. A fragment, somewhat longer, but incomplete.

Remark.—The copies of the foregoing inscriptions contained in section 6, are in good preservation; both as regards ink and paper.

Section 7. Copies of inscriptions at *Tiruporur (vulg.* Tripaloor) and other places between *Mavaliveram*, and Madras.

1. Gift of a proportion of rice-grain, for the maintenance of Brahmans at Tripaloor: the fane is one of *Subrahmanya*.

2. Gift of a village to the said fane; from persons who subscribe their names.

3. Dated in the 15th year of *Vijaya-Canda Gopala-dever.* Gift of 5 cows to supply butter-oil for a light in the fane.

4. Dated in the 10th year of *Vicrama Cholan.* Gift of a piece of land to the fane by private individuals.

The preceding are the only inscriptions at *Tiruporur*; but it is added in a note that the fane was built in Sal. Sac. 1429; and that some much defaced inscriptions remain, having been chipped out by a chissel. The writer asks instructions as to whether more labour and pains, ought to be bestowed on them, or not.

Copy of an inscription at *Taiyur.*—1. Dated in the time of *Achyuta-deva-rayer* in Sal. Sac. 1458. Gift by an individual named *Titta Pillai*, son of *Appaiyar*, of a village for the support of the fane, with a heavy denunciation against any one alienating the donation to other purposes.

Copy of an inscription at *Vellichakollutur.*—1. Gift of a tax by weavers on the productions of their looms for the benefit of the fane.

Inscription at *Tiruvottiyur.*—1. Gift of a certain proportion of grain; for the use of the fane, by persons whose names are subscribed.

Inscription at *Tiruvadantai* village.—1. Dated in the 11th year of *Sri Covi raja Kesari.* Gift of land for the service of the fane of *Varaha-svami* (of the appellative *nitya-calyana-svami*, a name of the image at *Covalam)* by certain *Vaishnavas*, who commemorate the donation by this inscription.

2. In the time of *Kullottunga Cholan.* Gift of rice, and other matters to the Brahmans of the fane.

3. Dated in the 19th year of the rule of *Covi Kesari.* Gift of a tax in kind, of rice and other agricultural productions, by cultivators, to the shrine.

4. Dated in the 8th year of *Cola-raja (Chola-raja ?)* "the decapitator of the *Pandiyan.*" Gift of a proportion of grain from the harvest, by cultivators.

5. Dated in the 8th year of *Ventaratipan.* Gift of 93 goats, to provide butter-oil for lamps.

Inscriptions at *Mamalipuram.*—This name seems to be intended for

Mavaliveram. It commemorates a gift of grain from persons subscribing their names; but is without any date.

2. Gift of land by persons subscribing their names. No date.

3. Dated in the time of *Deva-rayer*. Gift of 332 pieces of gold, and of some smaller sums for the service of the fane, for gathering flowers to adorn the image, and similar matters; the various allowances for different purposes being minutely specified.

4. Gift of land with a reservoir fertilizing the same to the *Vaishnava* shrine.

5. Gift of twenty-two cows, to provide a lamp with butter-oil. No date.

6. Gift of a piece of land with cocoa-nut trees growing thereon. Cycle year only specified.

Section 8. Tamil inscriptions extracted from a manuscript (a pencilled explanation, in Colonel Mackenzie's hand-writing, no longer legible).

1. An inscription of *Deva-rayer* Sal. Sac. 1270.

The purport of this inscription is to commemorate the construction of an *agrahâram* for Brahmans by *Deva-rayer*; who is termed the son of *Hari-hari-rayen*; and his ancestry is traced upwards. *Bukhan* is said to have founded *Vijayanagaram*, on the banks of the *Tungabhadra* river. *Deva-rayen* was respected by other kings, and praised by Brahmans, when they came into his presence. A minute specification is given of the location of Brahmans, distinguished by their *gotra*, or tribe, and by the Veda, which they studied: the entire inscription is curious.

2. The genealogy of the *Rayer* dynasty is given. It is dated in Sal. Sac. 1300, at *Pennaconda*. It commemorates the building or foundation, of the town of Pennaconda, ascribed to *Sika-deva-rayen*. It is very brief.

3. Dated in Sal. Sac. 1303. This inscription gives a particular statement of the parentage of *Bukha-rayen*, the founder of the *Rayer* dynasty; mentions his brothers, the name of his wife; and states his son to have been *Hari-hara-rayen*. It is of considerable importance; particularly as to the parentage of *Bukha-rayen*.

4. The said *Hari-hara-rayen* built an *agrahàram* for *Brahmans*, and the distribution of the said alms-house among them is specified, by tribes and portions.

5. Dated in Sal. Sac. 1701. The commencement of the lunar-race is given, and deduced through the line of *Crishna* of the *Yadava*-race, rul-

ing at *Dwaraca-puram.* One of this line, named *Sáluva,* saw a hare chase a tiger, and considered the place to be propitious............... (Here there is a chasm, by reason of some leaves being cut out from the book).

19. *Crishna-rayer, Achyuta-rayer, Rama-rayer, Tirumala-rayer* and *Sada-Siva-rayer*, are mentioned ; and an account follows of a repulse experienced by *Narasingha-rayer* in an attempt to take Seringapatam. The assumption of power by *Rama-rayer,* and his defeat by the Mahomedans are stated. He was succeeded by his son *Sri-rangha-rayen* who ruled at *Pennaconda.* He established his brother, named *Vencatapati-rayer*, at *Chandra-giri,* and another brother named *Rama-rayen* at Seringapatam. After the death of *Rama-rayer*, a district chief took Seringapatam, and the news coming to the knowledge of the Pennaconda ruler............

(The following matter is wanting, owing to the leaves having been cut out from the book. This last fragment is not an inscription : but part of some historical narrative the value of which cannot now be determined).

General Remark on MS. Book, No. 50.

The whole of the contents of this book have been carefully investigated, and brief results indicated in different portions of my several reports. Copies have been taken of various portions where the ink was found to be pale, and becoming illegible. Section 6, herein noted, is in good preservation, and has not been re-copied. A copy has been taken of section 8, because, though unhappily very imperfect, its contents are of value. The whole examination gives no results of great antiquity. There are some few documents of consequence. The greater portion are of little historical use, from wanting the dates of the *Sacai* year ; but they illustrate the spread, and influence of Brahmanism ; and give views of the practical working of idolatry, which in any bearing upon the improvement and elevation of the people at large, are of momentous import. As such, may the brief outlines given be well considered.

Manuscript book, No. 13—Countermark obliterated.

Section 1. Account of the *Nayanmar*, in the Malayalam country.

A specification of local customs, and usages of four subdivisions of the *Nayanmar* named respectively *Ilam, Surubam, Tamil,* and *Patha-mangala.* Social intercourse ; what persons can enter the houses of others. Astrological precautions, before determining on marriage. Mode of con-

ducting marriage ceremonies. Plurality of husbands; and consequent manners, of great laxity. Modes of proceeding, consequent on the death of any one of the parties. Modes of dress. The *Nayanmars* have lengthened ears, like the *Maravas* of the Tinnevelly country; and, like them, wear jewels in their ears. (This custom on enquiry I find to be peculiar, in Malayalam, to the *Nayars*). Other details concerning the intercourse, of the most licentious kind, between the wives of the *Nayars*, and the *Namburi* Brahmans. Modes of subsistence. The *Nayars* sometimes officiate as accountants; but they disdain any trading, or trafficking, employment. They eat flesh, and drink strong liquors. They are debauched, and irregular, in their habits. They are destitute of honesty and moral principle; so much so, that their word merely is never taken; and people will trust to nothing but written security from them. Their morning and evening meals; utensils, habitations, and connected matters. Depraved, and polluted, as this class are stated to be, yet it is observable that if one of a lower caste, or if an outcaste, trespass in even so small a degree the prescribed distance of approach, the *Nayar* must bathe in order to wash away the contamination; thus following a very common error of making a ceremonial contamination a matter of greater magnitude than moral turpitude. Some other details follow, concerning the modes of proceeding by parents, in marrying out their children. Means employed of providing for children, who have lost one, or both, of their reputed parents.

The customs of the *Polemar* are stated. They are a class of Brahmans, and have their own customs. Some of these indicate their having come from the *Tuluva* country; that is, the most northern division of Malayalam.

Remark.—The foregoing paper affords further attestation of the affinity, as to origin, between the *Maravas* and *Nayars;* heretofore observed in a note on a paper formerly abstracted.

Sections 2 to 16. Are entirely occupied with minute details, as to allowances daily to temples; revenue proceeds; and the like; of no consequence whatsoever; and therefore passed by, without being re-copied, and not susceptible of abstract.

Section 16. Boundaries of *Puntalam.*—From a slight mistake of my directions the writer copied this section: as it is somewhat more connected than preceding matter, but it is of no consequence.

Section 17. Account of the fane of *Mahadeva,* at *Puntalam.*—The etymology of the word *Puntalam,* is from *pú* a flower and *St'hala,*

a place; which by the rules of Tamil orthoepy becomes *Puntalam.* What little is stated is not of any consequence.

Sections 18 and 19.—The former a rude attempt to delineate the fort of *Conatur,* with its fane; the latter a trifling account of revenue proceeds; passed by as useless.

Section 20. Notice of the *Panikar* living in *Conatur* district.—A few details concerning this class have been copied; but of trifling consequence.

Sections 21 to 26 having little or nothing in the book answering to the section titles prefixed, the few loose and insignificant details given, have been passed by.

Section 27.—Account of *Vámanapuram* the residence of the *Atingal* chieftains.—A brief statement concerning this town has been copied; but it is insignificant.

Section 28. Account of the *Irzhavar* tribe.—A few unimportant matters, respecting them, have been copied.

Sections 29 to 32. Indicated in the section-titles to contain revenue details, have only 3 or 4 pages answering thereto in the book, of trifling and insignificant matters.

Section 33. Account of the *Nambiyar* Brahmans at *Cochin.*—A legendary statement as to their origin.

Section 34. List of commercial goods in the district of *Puranàd.*

Section 38. Legend of *Mánica-cshetram,* at the village of *Irankal-gudi.*—An ascetic discovered a jewel; which, in process of time, came to be worshipped as a god.

Section 42. Account of *Pulapanàd.*—Some legendary matter of no value.

Section 44. Account of *Codagnalur.*—The derivation of the name is given.

Remark.—This book having been found to be in a wretched plight as to paper, ink and general preservation, was given to a copyist to do what he could with it; and the results are stated in what goes before, after hearing the whole read over. They are of so little value, that the book might have been allowed to perish; though it is my wish not to permit any part of the collection to do so if it can be preserved; that is if recoverable.

Manuscript book, No. 7—Countermark 900.

Section 1. Details concerning the Brahmanical, and other tribes, in Malayalam.—Some details concerning Brahmans, and divisions of tribe, originated by *Parasu Rama*. Afterwards the *Musu-jati*, a tribe of temple servants are described, and the *Vaitiyar*, or medical class. The *uril-parichi* deduce their origin from the circumstances of a war entered into by *Kulasec'hara Perumal*. The *Cshetriya-jati*, or military class, is subdivided into three tribes. *Ambala-vási* or dwellers in a fane, are of mixed origin. The *Pushpacanmar* have no restriction, as to not marrying a second time; they gather flowers for the use of the idol. The *Pshárodi*, derived their origin from a Brahman who forfeited the privileges of his tribe. The *Variyar* derive from the marriage of a Brahman with a *Sudra* woman; and perform various offices, as servile assistants to Brahmans. The *Marayan-jati* beat drums, &c. in fanes at the time of offerings. The *Curupu* play a kind of lute. *Chákiyár-nambiyár* are minstrels, who sing the praises of Brahmans, and kings. *Atizal* were Brahmans, who from becoming worshippers of the *Sacti*, or negative power in nature, became degraded. A list of subdivisions of the *Sudra* tribe follows.

Section 2. Account of the fane at *Tirukan-kodu* from the writing of a Brahman.—In the year of the Collam era 982, two brothers gave some land to this place. There is nothing else in this very brief section.

Section 3. Account of proceeds of different kinds of lands in the *Cavalapar-nad*.—This short paper relates to revenue proceeds, of no permanent consequence.

Section 4. The genealogy of the zemindar of the said district, is in the Telugu language. (See that part of this report).

Section 5. Copy of a record concerning *Calicut,* preserved in the hand-writing of a *Senatipati*, written before the times of disturbance.—(This section is in the Tamil character, and in the midst of Tamil documents; but, on examination, the language was found to be Malayalam).

The above mentioned *Senapati*, or commander of troops, was in the service of the *Calicut-raja.* He was of the *Taracal-vamsa;* a family which possessed peculiar privileges, as military chiefs, in connexion with the *raja*. Mention is made of one such chief, and of the subsequent want of posterity, supplied by adoption. Various kinds of deeds, grants, orders, and the like, were not valid, merely on the signature of the *raja*; requiring also that of the chief of this family, and the signature of another minister of the *Mangnatacha* family. These things bear on the local customs, and government, of that part of the Malayalam country; but there does not appear to be any thing of historical interest of a general kind.

Section 6. Geographical account, written in the Malayalam language. —In this paper also the characters are Tamil, the language is Malayalam. The document is an itinerary, or travelling journal, of one named *Canyuru-Namburi,* during a period of 11 or 12 years, between *Collam* era 863 and 874, respecting his journey from the Malayalam country to *Casi* or Benares; stating the names of places of repute, as shrines, or bathing pools, visited by him; and lying intermediate between Benares, and Ramaseram. He further adverts to Himalaya, on the north, and to *Irza* or *Singhála,* on the south; the latter of which he terms *Lanca.*

Section 7. Copy of a palm-leaf record of the *Cutheri-vatta-nayar* of *Naduvattam* in the *Palcad* district.—This section is also Malayalam, in the Tamil character. It relates to the local rules, or customs on which the fief or barony, of the said *Nayar* is held from the *Samotiri-raja*, or Calicut ruler. On the installation of a new *Nayar,* a certain sum is paid to the minister of the Calicut ruler. On the death of a *Nayar* information must be sent to Calicut, with the mention of the legal apparent successor whose nomination needs confirmation from Calicut. The expences incurred on occasions of the installation, marriage, or funeral, of a *Nayar,* are stated. The form of writing to the Calicut chief, announcing the death of a Nayar, with the legal successor, and the form of the Calicut ruler's official reply, when affirmative, as to a successor, are given.

Section 8. Copy of an old record of the *Puthucheri agraháram*, preserved in the hand-writing of the *Manradiyar* of *Vadacheri*, in the *Palcad* district.—The *Manradiyar* was a petty chief who held a small country, of a few leagues in circumference, which was forcibly wrested from him, by the Travancore king; and afterwards made over to the Calicut ruler. The chief portion of the paper relates to the laws, and regulations, of the said small barony; as to marriage customs, and observances; domestic rules, and restrictions; rights, and privileges of Brahmans; and the illegality of any sale of land, which must go by hereditary descent. It is of local importance only; but the existence of distinct laws, in various small districts, confirms other indications, as to the want of extensive imperial power in the Malayalam country.

Section 9. Account of the fane at *Tiruvalattur*.—There are some loose and unconnected lines as to *Chittur* village, and *Tiruvalattur* fane, but mere fragments, and by consequence of no use whatsoever.

General Remark.—This book was observed to be in a damaged state: it has (with the exception of sect. 9) been restored; section 1 to 3 in the Tamil language: section 4 is in Telugu (see that portion of this report) section 5 and 6 as found in the Tamil character; but section 7 and 8 are copied in the Malayalam character, as best suited to the Malayalam language. The Tamil character disguised the language of the latter sections, at first; especially as the opening sections were wholly in Tamil. The importance of the contents does not seem to be great; but, on the whole, it may be of some use to have rescued, what is of any consequence, from destruction.

Manuscript Book, No. 12—Countermark 905.

Section 1. Account of a shrine of *Crishna* at the village of *Ambalapurai* in Malayalam.—A child troubled a *Sannyasi*, by doing mischief to sacrificial implements which made the said ascetic angry; whereon the child disappeared, and was discovered to have been an apparition of the god. Much inane matter connected therewith; leading however under the influence of superstitious credulity, and of the *Namburis*, to the construction of a fane, with its shrines, out-buildings and appurtenances of festivals, allowances for them, and grants in land: the whole dedicated to the service of *Crishna*. At a late period the minister of the Travancore *raja*

made war against the head *Namburi* of this place. The details indicate that the head *Namburis* had acquired great influence, and consequence.

The account was collected by *Nitala-Narrayan*, who visited the various fanes accompanied by Mr. Ward. According to the description given, this one with its various appendages, is of more than usual magnitude, and splendour.

Section 2. Account of the Syrian Christians, in Travancore.—*Nitala-Narayan* states that being in company with Mr. Ward (an officer of the survey department) a document in the Lebbi language (probably Syriac) was explained to him in Tamil, which he embodied in the contents of this paper.

At a former time seven persons of a strange religious persuasion came to Travancore; among whom the name of Mar Thomas occurs. The king of the country had previously received some admonitions respecting them in a dream. They called on the king to embrace their system, and to allow them to build places for their mode of worship. The king demurred to their claims and said these must be proved. He also summoned a council of *Brahmans*, enquiring if the new system ought to be received; who replied most certainly not. The foreign persons ascribed to themselves the faculty of retaining the soul (when departed from a body) in the air above, and of recalling it, so as to re-animate the body; and, as stated, gave a proof of this power in the case of one among themselves. The king, however, resisted their claims. Soon after the king's younger brother died; whereupon the recently arrived strangers told the king that if he would build seven churches in different places they would restore his brother to life. The king made the promise, and the body of this brother became re-animated, awaking as if out of sleep. In consequence both the king, and his brother, adopted the new system, and along with them sixty-four householders with their families: these received the initiatory rite of baptism. Thirty-two householders refused to adopt the new mode of credence; and created disputes. The younger brother requested from the king one-tenth of his revenues, which the king granted; and, with the proceeds, the younger brother had seven churches built, in different villages. Mar Thomas was killed, and afterwards respectfully buried. In consequence of the disputes, a message was sent to Syria; whence a person came, on board ship, as spiritual superior of the Christians. At a later period *Manica-vasacar*, a person who chanted panegyrics, came to Malayalam, and disseminated the *Saiva* five-lettered system; teaching to swallow the *Saiva* compound of five substances; and to use the

Vibuthi, or sacred ashes. He drew away several families. The head of the Christians received various privileges and immunities from *Cheruman Perumal*, who always directed the election of the *Metran*. A council, or synod, was formed for the settling of disputes. Other details are given; with mention of the first arrival of the Portuguese, termed the Cochin-Feringhis. An interference of a Roman Catholic, claiming authority over the Christians, is mentioned; whom the Cochin *raja* put in fetters. A reference was made to Rome on the subject. Subsequent matters are stated; chiefly relating to discussions between the Syrian, and Roman Catholic Christians. A Roman Catholic bishop arrived; whom the Syrians refused to recognize. The affairs of the Syrian church in Trávancore are narrated, down to a recent period.

Remark.—The preceding abstract is much too brief; and very imperfect. But I have allowed it to be so, partly because it is probable that I may take an early opportunity to translate the document, which is of some length; and, as it seems to me, of some value as an authority.

Section 3. Account of the fane of *Callara-cota* in *Malayalam.*—Legendary reference to birds killed with an arrow by *Arjuna*. A fane was built; but there is no *St'hala-puranam* relative thereto.

A sort of itinerary follows, written by *Nitala Narayan;* briefly mentioning heathen edifices visited by the way. Four of these have only a few lines appropriated to each; with trifling details of no value. In the table of contents, each of these short paragraphs is entered as a section. Section 8, relates to *Vallabha Cshetram*, concerning which a long legendary account is given, but as puerile as can well be possible. A few dates of the early part of the *Collam* era are stated, with mention of some rulers, which may be of use. The place seems to have risen to celebrity, and to be one of much resort at its festivals. Sections 9, 10, 11, 12, are merely brief paragraphs of an itinerary: the subjects relating to places of inferior note.

Section 13. Account of the fane of *Panniyanna-naru-cávu Bhagavàti* near to *Manàr*, in the district of *Tiruvalla.*—With this section a third division of the manuscript book begins. Some legendary matter, of no consequence, is stated. It then appears in the statement, that an annual human sacrifice of peculiar atrocity, was accustomed to be offered. The person proper to be so sacrificed was a woman, pregnant with her first child. Such a woman, being selected was brought to the shrine; and there killed by being beheaded with a sword; so that the head rolled up to the image, and the

blood of the victim was sprinkled thereupon. The origin of this sanguinary sacrifice, as to any date, is not specified; but it is stated to have been regularly of annual observance, down to the year of the *Collam* era 918. In C. E. 919, an *ávésham* or possession of the spirit resident in the said image, came on a by-stander, at the time when the sacrifice was to have taken place, directing that for the future human sacrifices at her shrine should be discontinued. (That year corresponding with A. D. 1743 the said afflatus of the evil spirit, can be accounted for, as a precautionary measure). From that date human sacrifices have been set aside. Moreover the posterity of the woman and child, spared on that occasion, now bear the name of *Adichamar*, who live in a village divided into the north and south quarters, being four or five households, and inclusive of their children, amounting, when the account was written, to 40 or 50 souls. They receive offerings made to the shrine; and by an order from the *rajah* they are exempted from the payment of any taxes. There is a small river near the said fane, and since the Collam year 920 annually on the day when the sacrifice used to be made, the headless trunk of a dead body is seen on the river bank. No explanation of this circumstance is offered; and, if any be asked, the only reply given is that it is "a divine secret."* (The inference of course is, that the sacrifice was only publicly discontinued, but is still privately practised, possibly during the night). At the present day a public sacrifice of sheep is substituted for the human sacrifice. At this fane there is neither inscription nor *St'hala-puranam.*

Section 14. Account of the *Siva-cshetram* at *Corandi*, in the same district.—In the time of *Parasu-Rama*, an evil spirit built this fane, in the course of one night. No females are allowed to enter; not even the queen. These must pay homage outside, men only may enter withinside.

Section 15. Account of the village district of *Sanganacheri*, with its village of the same name.—There is nothing of any consequence in this section, beyond the mention of the building of the village fane.

Section 16. Account of *Siva-cshetram* of *Candiyur* in the *Mavalikarai* district.—The name of the district is derived from *Mahabalichacraverti.* The fane is one of *Crishna.* The term *Candiyur* arises from *Mahabali* having been resident, or seen there. (An example of

* *Daiva rahasya.*

the liberties taken as to names and localities). It had its own chief; but in *Collam* era 920 it was seized by the Travancore *raja*. Access to the *St'hala-purana* could not be gained.

Section 17. Account of the fane of *Maha-deva* at the village of *Pandala*.—The name of the village seems to be properly *Puntala*, meaning "a flower garden." This district had its proper chiefs. A *Pandiyan* king ruling over *Ten-Casi* (the southern Benares), having no offspring, adopted a child; but the people of the king refused to recognize that adoption. In consequence the rejected person took away much wealth from the place, and with it retired to Malayalam; where he purchased extensive estates, forming this district: over which he, and his posterity, ruled. It was however forcibly seized by the Travancore *raja*; and a few descendants only of the original proprietors remain; these being now poor and miserable.

Section 18. Account of the fane of *Maha-deva* in the village of *Venmanni*, of the *Puntala* district.—Certain lands were made over to the fane, in the hands of Brahmans of the *Potemar* tribe; who, in consequence, conducted the usual ceremonies and offerings.

Section 19. Account of *Tumbuman*, a fane of *Subrahmanya*, in the *Puntala* district.—A possession of the spirit of *Subrahmanya* came upon a certain Brahman, ordering a fane to be built; which was accordingly done. Nothing further is mentioned.

Section 20. Account of the *Sevacshetram* of *Senganur*, in the *Mavalikarai* district.—Legendary matter, as to an appearance and marriage of *Siva* with *Parvati*. At the time of the primary marriage the concourse was so great that the earth could not bear the burden. A certain *rishi* received an order, in consequence, to go to *Senganur*. He objected to the doing so, without having seen the marriage ceremony; but was dismissed with the assurance that *Siva* and *Parvati* would come thither and be married, for the fourth time. The promise was accordingly fulfilled; and on that event the construction of the fane, and observance of its festivals, are made to depend. *Parvati* being subject to ceremonial desecration (according to the custom of women), ceremonial homage should not at those seasons be paid; but a *Namburi* Brahman ignorantly going to the shrine, at such a time, was violently assaulted by the spirit of the image, and afflicted with severe visitation of

the variola fever. A *Tantri*, of another class of hierophants, gave a proper explanation of this circumstance; in consequence of which, processions were formed to carry the image to the river to bathe, after the said time was past. Festival observances are connected with these processions. (To all evasions as to images being only tokens of remembrance of one Supreme, assisting the mind in His worship, such instances as the preceding may be opposed in reply. The puerility of idolatry, amazing as it is, could hardly proceed further than in the aforesaid example: it is on this account solely, that I allow of its mention). The fane was burnt to the ground in *Collam* year 940; and not a vestige remains.

Section 21. Account of *Armulai* fane, in the district of *Tiruvallà*.—Reference to the times of the *Pándavas*, and to five places dedicated by *Bhishma* to *Bhu-devi* or the goddess of the earth, of which this was one. At the festivals large bamboos (termed *Mulai*) were brought from the mountains, to form a booth before the fane; whence the name *Armulai* (six bamboos) is derived. Certain old observances formerly existed; but have not been revived since the place was burned down to the ground in C. E. 940 (A. D. 1764).

Section 22. Account of the fane of *Pat'ali Bhagavati*, in the *Cottakarai* district.—A spirit of *Bhadra-Cali* seized various animals as tigers, alligators, and the like; doing much mischief to the country. She also appeared to three persons in a dream; ordered a fane to be built; and promised in such case, to guarantee the country from hostile invasion. In consequence an image was painted on glass, according to the form of her appearance in vision; the same was placed, and ritually set apart by *Pratishta*, in a fane built to her honour: in which the usual observances were continued.

Section 23. Account of the fane of *Mannádi-Bhagavati*, in the village of *Mannádi*.—A potter, and his wife, lived on the banks of a stream; where a ferry boat was stationed. Two *Brahman* women, and two *Sudra* women, called to the potter's wife, one day, to send over the boat; which she stated herself to be unable to do. They bid her loose the boat; and it would come of itself. She obeyed, and the boat went over, and returned. The four females thanked the potter's wife; and announced to her much good. She begged of them to lodge for the night; to eat in one hut; and sleep in another one. They consented: and the potter aided his wife in procuring for them fruits, and other refreshments. In return they announced to him, that he would be chief of the district. During

the night all four were found to have disappeared; and a possessed *Caradi*, or black bear, appeared; commanding in the name of *Bhadra-Cali* that a fane should be built, which was done. The potter, and his wife, by means not stated, became possessed of the district. In bringing offerings to the shrine, the people who do so present them to the descendants of the said family.

Section 24. Account of the fane of *Pávumpávi-dever*, in a village of the same name in the *Manapalli* district.—The origin of this fane is ascribed to the following circumstance. A wood-cutter in the service of a *Nayar* when performing his work in the woods, whetted his instrument on a stone; and some others did the same. During three days nothing particular occurred; but on the evening of the fourth day, when the instrument was being whetted, blood flowed forth from the stone. The man told the circumstance to the *Nayar;* who came, together with three or four *Potemar* Brahmans. These, supposing it to be some god, had a booth erected over it; which in process of time became a shrine and fane; having its attendants, festivals, offerings, and the like, as usual in other places.

Section 25. Account of the fane at *Cáyan Colam*, belonging to the *Concani* people.—Formerly, and more than three hundred years ago, in consequence of a disturbance in the *Concan*, several persons emigrated thence and came to Malayalam, where they received permission to settle, from the Cochin raja. In consequence, they formed a distinct community; and built for themselves fanes: the one mentioned among others; connected with the usual observances.

Section 26. Account of the mosque of the *Iona-mapula* people in Travancore.—Their cazi, and some other leading persons, are mentioned. Their pecular usages, and customs, are adverted to. Their class is said to have received great increase from the accession thereto, as well of *Namburis*, as of other people.

Attached to this section, is a further brief mention concerning the Syrian Christians termed *Nasrani* (that is Nazarenes): it chiefly relates to ancient books. One, written four hundred years since, is stated to be in the old *Malayala-lipi* or character. Others are spoken of as in the Syria *lipi*, and are probably intended to denote the old Syrian MSS. of the Scriptures; one of which was purchased by Dr. Buchanan. The name of Mar Thomas herein occurs; and also some mention of the

Syrian bishops; but the brief notice is such as a Brahman, and a stranger, might be expected to write. There does not seem to be any wilful prejudice.

Section 27. Account of the fane of *Rani Cavu*, in the village of *Rampulam* in Travancore.—It belongs, as hereditary property, to a *Namburi* Brahman who officiates. Little else is added, and besides many letters have been destroyed by insects.

Section 28. Account of the fane of *Nangaiyar Curangnari*, in Travancore.—Fabled to have been the hermitage of *Mricandiya-rishi*. A woman and child, passing that way, bathed in a neighbouring pool; and meditated on *Vishnu*. In consequence *Vishnu* personally appeared, and *Mricandiyar* seeing this appearance, there placed an image of *Vishnu*, which now receives all customary honours.

Section 29. Account of a fane of *Subrahmanya* at *Aripattu*, in Travancore.—The circumstance chiefly referred to in this paper is that of a great number of Brahman children being fed at this fane; and spoken of as belonging to it. A superstitious dread of saying, or doing, any thing against them prevails. *Rama-raja* of Travancore, once seized and imprisoned one of them, for some mischief committed: for doing so his arm swelled; and he released the boy, paying a fine to the fane, and apologizing for his ignorance. Hence no one dare speak against the said children; without incurring the anger of *Subrahmanya*. The document has suffered great injury from insects.

Remark.—This book was put into the hands of a copyist to be restored, on account of its greatly injured state by *termites*. The doing so has only been partially successful; many omissions of letters, words, and sometimes sentences, remaining. The contents are of greatly differing interest, and value. Heathen superstition is herein painted by the hand of *Nitala-narayan*, himself a Brahman, in its most puerile form. Moreover the shocking cruelty mentioned in section 13, can hardly escape notice. Surely no one can regret that Christianity has planted its foot, diffusing more genial influences, in that very neighbourhood.

Manuscript Book, No. 53—Countermark 1027.

Inscriptions on stone, and paper grants in the Malayalam country.

The materials on which this book is written, are China and country paper; and with some mere memoranda in pencil. The language is quite a *melange ;* consisting of a little Malayalam, some Sanscrit *s'ocas*, a large proportion of Tamil, mingled with *Grantha* letters, and some few portions of documents in what is termed Malayalam *lipi* (characters). A perusal of the whole shews the contents to be incriptions, but of no considerable antiquity : being subsequent to the formation of the *Collam* era, and entirely referring to grants of land and other immunities, to fanes, and their attendants, by the raja of Cochin and a raja of *Cherckal ;* the origin of both of whose power is subsequent to the division of the country by *Cheruman Perumal.* Such being the case I have neither thought these documents worth minute abstract, nor the book worth re-copying where practicable. At a subsequent period, if leisure or opportunity occur, it may be looked at again, and any documents that may be in danger of perishing can then be restored. The book will continue legible as it is, for a few years longer.

Manuscript Book, No. 12—Countermark 54.

Muppanto'tilulà a panegyrical poem on *Sôma-nát'ha*, the tutelary god at *Muppantotti.*

This book contains a poem, of the kind termed *ula*, referring to the fane of *Sóma-nat'ha*, and consisting of seven *adhyáyas*, or sections; the subject of each section referring to a distinct *sacti*, who is represented as coming to the shrine, and becoming enamoured by the perfections of the idol. The book is somewhat damaged by insects, and the ink is rather pale. I deem it however unworthy of restoration.

Note.—The entry in Des. Catal. vol. I, p. 177, art. 38, would have led me to expect something better from it. However there remains a palm leaf copy No. 228 to be examined ; referred to a subsequent report.

Manuscript Book, No. 40—Countermark 336.

Account of *Tirunamalai*, or Trinomalee.

This book is a thin duodecimo; with only about one third written. Its object is to commemorate the visits to the shrine, of four kings, or local chiefs ; that is *Vajránga-Pándiyan ; Sambhava-rayer ; Valala-rayer* and *Devà-maha-rayer.* These persons, on their visits, made certain additions to the fane. In the times of disturbance, occasioned by Hyder Ali, several documents belonging to the place were lost.

Remark.—Though this brief mention of the contents is probably sufficient, as to any valuable purpose; yet as the papers are loose, the country paper very thin, and partly injured by insects, I have on the whole thought it as well to have it restored.

Note.—The book is entered in Des. Catal. vol. 2, p. L. art. 40.

Manuscript book, No. 8—Countermark 762.

Section 1. Account of *Periyobaiya Condama-nayak*, local chief of *Ayacudi* in Coimbatore.—The account commences with the dates of C. Y. 4400, and S. S. 1321, when the head of this line was despatched, by the Padshah of Delhi, against the Mahrattas. A sanguinary contest occurred, leading to an explanation, and subsequent agreement. *Ubaiya Condama*, was afterwards invested with honours and distinctions. He, with his family, emigrated in consequence of the Padshah, whom they served, requiring wives from their tribe; to which they could not consent. They settled in the south, at *Ahóbalam*. The defeat of the *Pandiyan*, by the *Chola-raja*, subsequently occurred; leading to the appeal of the former to the *Rayer;* and the sending of *Nagama Nayakar*. His usurpation; the sending of *Visvanát'ha* to bring his head; the accession of *Visvanàt'ha* to the rule at Madura; the building of a new fort; the appointment of *Ariya-muthalaiyar* to be chief minister of state, are narrated. Subsequently there is legendary matter to account for the establishment of the fane of *Ahóbala-isvara*. The first of the line ruled there as a feudal chief for 30 years: his son 15 years. Other descents of the chieftainship are mentioned. There is nothing particular beyond, except the Mysore invasion; and, at a later time, the war against Tanjore. The subsequent transactions, towards the close of which the English became concerned, are narrated.

Note.—This paper as being of some value, and from the ink of the record being faded, has been restored.

A brief statement of the assumption of the *pálliyam*, by Government; and also an incomplete notice of the line of *Rama Bhadra Nayak*, follow. The first is of no moment; and a full notice on the latter has heretofore been given.

Section 2. Account of *Padmachala*, and of its fane, in the Coimbatore country.—This account professedly is extracted from the *Scanda-puránam;* some *adhyáyas* of which are copied. The object is to account

mythologically for the veneration said to be due to the hill; and to narrate the first formation of different *Saiva* emblems found thereon, with their connected shrines. Nothing beyond this simple indication of contents is required.

Section 3. Legend of the fane of *Narasinha Perumal* in the Tinnevelly district.—Under this section brief notices of various *Saiva* emblems are comprised; offering nothing deserving of special notice.

Section 4. Account of *Tádi-Combu*, an *agrahâram*, in the Coimbatore district.—The account does not ascend higher up than S. S. 1400, and has some minor details; not meriting much notice.

Section 5. Account of the fane of *Ahóbala*, named after *Narasinha-svámi.*—Legendary details concerning this fane, and others in the neighbourhood, are comprised under this section.

Section 6. Account of *Cutheraichuni.*

Section 7. Account of *Cannivádi* and *Cotapalli.*—A legend as to the first mentioned place; and other legends of places in the *Cannivádi*, and *Cotapapalli*, districts, are stated: each one brief and of no importance.

Section 8. Legend of *Manar-koil*, at Cape Comorin.—The legend is founded on a mythological fiction of *Siva's* coming to the south; and there being again married to *Parvati*, as *Canya-Cumari.* Similar legends are common to most of the *Saiva* fanes, in the peninsula.

General Remark.—This book is a little injured in the covers; and slightly touched by insects: the ink also is faded. Still it will last, as it is, and be legible for several years, with only common care. Its condition would point it out for restoration, were the contents worth it; which, with the exception of the first section, does not seem to be the case. All the remainder, at least for the present, is passed, without further attention.

Manuscript book, No. 5—Countermark 50.

This volume is a thin folio, and contains two parts; the first a legendary account of *Pádmachala*, professedly extracted from the *Scanda-puranam*; the second an incomplete copy of the *Bhúgóla-pramánam*, or system of Hindu geography. To the legendary details of the first it may perhaps be expedient to return, more at leisure; as a few grains of wheat may be picked out of the chaff; and the more especially since the country paper is a little touched by insects and the ink in several places faded. More important matters requiring notice, this may be passed, for the present, with a general indication as to its state of preservation. The other fragment is written on Europe paper, and will remain legible a long time. It may also be referred to the notice of a palm-leaf Tamil MS. bearing the same title, with the like contents.

Manuscript book, No. 53—Countermark 1022.

The contents of this book are of a very miscellaneous description. In the index three sections are specified, as containing respectively inscriptions from Trichinopoly, Coimbatore, and Tanjore. The included matter will appear from the following brief outline.

1. At Trichinopoly, gift of land at *Ayilur*, by *Vaiyapa-nayak*, who deduces his descent from *Achyuta-nayak* to whom a long string of titles is ascribed. The gift is perpetual, to support car-festivals, and other expences of the fane of *Tiruvalesvarer*, with heavy denunciations against any alienation of the gift to other purposes.

2. A hand-writing given in by one or two individuals, specifying certain donations relative to a large lake for irrigation. One uncertain date appears, and another date S. S. 1634, with the name of *Crishna-raja-udiyar* (of Mysore).

3. A Canarese inscription. It records certain donations made by *Crishna-raja-udiyar* of Mysore, to a fane of *Visvanat'ha-svami* at *Bhuvani-kudal*, in the Coimbatore province. The grants consisted both of land and money; of which a list is given. There does not appear any *Sacai* year; but the date of course is modern.

4. Legendary matter as to the establishment of a *Saiva* emblem in the *Dharapur* district, by the command of a visionary appearance. Some gifts made to it were partly continued, and partly subverted after the Mysore conquest.

5. Details concerning an *agraharam* in Coimbatore province, with gifts made, and fluctuations of power. The establishment of the alms-house is dated in S. S. 1100. It is signed by some inhabitants.

6. Details concerning another agraharam, and fluctuations of power indicated. Constructed in Sal. Sac. 1523.

7. Particulars of grants made to the fane of *Antiyur* in the Coimbatore district, the earliest date is S. S. 1502.

8. Specification of grants to an *agraharam* at *Hobhalli*, in the *Antiyur* talook, the earliest date is Sal. Sac. 1200; the interference of Mysore kings appears. No tax paid to the Honourable Company.

9. Like matter with reference to an *agraharam* at *Samba*, going up to the 13th century of *Salivahana.*

10. An oral statement of a person concerning some claims referred to the collector.

11. With reference to an *agraharam* in *Chacra giri* hundred, mention is made of the early *Congu* line of rulers, and then of the succession of the *Rayer* dynasty. No certain date is specified higher up than the 13th cent. of *Salivahana.*

12. Particulars concerning a fane in the *Antiyur* hundred and mention of wild tribes living on a hill near it, who wear no clothes, and live on roots, or other spontaneous productions of the earth. Mention of a fort built by a *Vedar* king.

13. Particulars of an *agraharam*, and its possession going up to S. S 1105, and descending through various fluctuations of power as respects taxation imposed.

14. Matters relative to an *agraharam* at *Andiculam.* A composition as to tax in S. S. 1620, in the time of a Mysore ruler.

15. Reference to a fane of *Subrahmanya* at *Sicala-puri*, where the said *Subrahmanya* for some unknown cause chose to dwell. Mention of a teacher of great repute who had many followers.

16. Certain specialties relative to a fane which has several images within it and a great number without side.

16½. Stanzas in praise of an *amman.* In that fane there are no rites of homage practised.

17. Refers to *Agatesvara*, or a shrine of *Siva* said to have been founded by *Agastya*, and mention of his coming to the south to dissipate the darkness of ignorance. Legendary reference to former *yugas.*

18. An inscription dated in the 10th year of *Vira-Pandiya-dever.* Gift of land. Letters of the inscription, from being very old, cannot, it is stated, be read or copied.

19. Hand-writing of specified individuals relative to an *agraharam.* The earliest date given is Sal. Sac. 700, but it is doubtful if the writers did not mean about 700 years ago. Nothing answering to so high antiquity as S. S. 700 appears.

20. A local legend relative to a shrine of *Subrahmanya* as the slayer of *Suran*. Reference to the 13th *adhyaya* of the *Scanda-puranam* for an account of the splendour of the place. Certain old records were lost in times of disturbance.

21. Account of a fane at *Cadiyur* in the district of *Dharapuram*, given by *Brahmans*. Legend of *Siva* dancing in the forest. A *Pandiya* king, directed by a vision, obtained a victory in the said wilderness. The shrine has the traditionary fame of being self originated; that is of unknown antiquity.

22. Account given by *Brahmans* at *Agatesvara* fane. Some jejune matter panegyrical of *Siva* introducing the mention of his marriage at Madura. *Agastya* is mingled up with the account, and his fixing a *Saiva* emblem in the neighbourhood led to the name of *Agatesvara-vanam.* Various *tirt'has* specified with mention of the distinguished deities such as *Indra, Subrahmanya*, and others, who did homage at this locality.

23. Account given by *Brahmans* of *Cangaya* fane in *Dharapuram* district carried up to the *Kreta-yugam*, and a penance performed by *Brahma.* Other matter equally inane. As *Parvati* did penance there, the place seems to derive, from that alleged circumstance, its chief repute. The legend is said to be found in the *Curma-puranam.*

24. Legendary matter from older *puranas*, applied to a particular locality, with some appended jejune details. Inscriptions in troublous times were lost.

25. Account supplied by *Brahmans* of the fane at *Kannipuram*, in the *Cangaya* hundred of the *Dharapur* district. Legendary matter to account for the name. Besides older matter, the five *Pandavas* are said to have dwelt there, which affords some test of the veracity of the whole.

26. Legendary matter as to a fane at *Tiruvalur* which refers back to sixty-four great ages; to *Marcandrya-rishi*, and some later matters; of equal importance, and veracity.

27. Inscription and account of *Tiruvalur* fane in the *Valagudi* hundred, in the Trichinopoly district. *Valmica* was performing penance in this neighbourhood when a *Vedar* or wild hunter shot at him an arrow; but the sage taught him wisdom. Reference to the *Vishnu-puranam* for full accounts of the fane. It was greatly distinguished by ancient rulers; but was allowed to go to decay. *Chokarangha-nayak*, of modern date, had it repaired; and made to it a grant. It suffered from the Mahomedans. A few subsequent details down to the time of the Honourable Company. For a time its festivals were observed; but were afterwards discontinued.

28. Record of a grant by *Crishna-rayer* of various sums of money to *Vaishnava* fanes, in the Tanjore country; and a mention of his great munificence in the *Chola* kingdom.

29. A grant made to the fane of *Govinda-raja*, at *Chittambaram*, or Chillambram.

30. Record of a donation by *Achyuta-rayer* in Sal. Sac. 1461, to a fane at the same place.

31. An inscription dated in the 8th year of *Sri-coperu-singhu-devar.* Commemorating a gift of land by the *Chola* king, apparently intended by the above name, to the fane of *Sani-isvara-bhagavan*, at the same place.

32. Dated in Sal. Sac. 1400. Inscription in the fane of *Sabha-nát'ha*, to which *numen* a string of titles, verging on the ludicrous, is attributed. Donation of a village, in free tenure, to the fane; by certain head-men, whose names are specified.

33. Inscription on the eastern porch at *Chittambaram.* Dated in Sal. Sac. 1503, in the time of *Vencatapati-rayer* of the race of *Hari-hara-rayer.* Gift by certain head-men of the revenues of a village to the fane, for the customary offerings and ceremonies.

34. Inscription on the third wall. Dated on the 14th day of the rule of *Raja-raja-devar.* Gifts of fruits, and other productions, at the appropriate seasons, for the use of the fane, from persons of the *Wiyalvar* tribe. *Calinja-rayen* is the first name, but several others are included among the donors.

35. Inscription on the great porch of the fane of *Narasimha-svami* at *Manar-kovil.* Dated in *Cali Yuga* 4442, in the time of *Crishna-rayer.* The copy is imperfect, and what was given is not clear; but it seems to have been revenue arising from land.

36. On the third wall. Dated in the 10th year of *Sri-raja-raja-dever.* Gift by *Calinga-rayen*, and others, of grain arising from cultivation, for the service of the fane which contains the inscription.

37. Inscription dated in the 16th year of *Raja-raja-dever.* A gift of land by some head-men to the fane.

38. Gift of some money to purchase furniture, or utensils, for the fane in the reign of *Kulottunga Chola.*

39. At *Chittambaram* in the time of *Crishna-rayer*, in Sal. Sac. 1436, *Mannapa-nayakar*, gave a large grant of land to furnish food for the *Brahmans* to plant a flower garden and to build a choultry or *serai.*

40. At the same place. Dated in the 5th year of *Kula-Sec'hara-dever.* Gift of money to supply all customary articles of food for *Brahmans.*

41 and 42. Donations by Vicrama Tribhavana-raja.

43. Dated in Sal. Sac. 1515. *Crishnapa Condapa* gave some lands to provide butter-oil for the fane.

44. At *Sri-rangha-nát'ha* fane, on the 2d wall. Dated in Sal. Sac. 1851. Gift of a village, for the service of the said image, by one named *Vijayapar*.

45. Same place. Gift of 300 *huns*, to *Uttama Nambi*, by *Vijaya-bhupati-rayer*.

46. Dated in 1393. Gift of some money by head-men of villages, in the time of *Raja-vipada*. Also a gift of proceeds from the sale of certain lands for the service of the fane.

47. Dated in 1343. Gift of some lands for the service of the fane.

48. Dated in Sal. Sac. 1580. *Muttira Raman* gave some land, the proceeds to supply food to the *Brahmans* in the four pillared-porch.

49. In the time of *Vira-pratapa-dever* Sal. Sac. 1400. Gift of some land, for festival processions.

50. Dated in Sal. Sac. 1433, in the time of *Crishna-rayer*. A merchant gave some land for the service of the fane.

51. Dated in Sal. Sac. 1446, in the time of *Crishna-rayer*: his general gave some land for the use of the attendants on the shrine.

52. Dated in Sal. Sac. 1590. Gift by *Mutta Raman* of money, and rice-grain, for the festival services.

53. Dated in Sal. Sac. 1445. Gift of land by *Appaiyan*.

54. Dated in the time of *Achyuta-rayer* in S. S. 1452. Gift of money by two or three persons, whose names are mentioned.

55. Dated in Sal. Sac. 1496, in the time of *Vera-pratapa-dever-maha-rayer*. Gift of a village, including wet and dry lands, the produce to supply food to the servants, or attendants, of the fane.

56. Gift of two villages by *Anna-muttamal*, a lady so named. No date of year.

57. Dated in S. S. 1459, in the time of *Achyuta-dever-rayer*. Gift by *Roma Pattar* of *Uriyur* village; for the celebration of festival processions.

58. Dated in Sal. Sac. 1602. Gift of some lands made over to managers of the fane ; name of the donor does not appear.

59. Dated in Sal. Sac. 1473, in the reign of *Sada-Siva*. Gift of *Chola-nallur* village, and 109 pieces of money, to supply food for the fane.

60. Dated in the time of *Tribhuvana Chacraverti-Rajendra-Chola-dever*, 7th year of reign: gift of a flower garden to supply flowers for the image by *Narasingha-Nayak*.

61. Dated in Sal. Sac. 1596. Gift of money, for the service of the fane, by some head-men.

62. Dated in Sal. Sac. 1588. Gift of four hundred *huns* by an annual impost on a village to supply butter-oil, for the lamps, and for festivals.

63. Dated in Sal. Sac. 1591. Gift of two villages by *Alagiriyan* to the fane.

64. Dated in Sal. Sac. 1593. Gift by *Basavapa-nayak* of some lands, for the service of the idol.

65. Dated in Sal. Sac. 1613. Some regulations as to the order first, second, third, and so on, in which certain *Brahmans* were to put garlands on the idol, at the time of public processions.

66. Dated in Sal. Sac. 1588. Gift by sixty head-men, of land for the support of *Brahman* families, in an *agrahâram.*

67. Dated in Sal. Sac. 1596. *Choka-nat'ha-nayaker* gave a village; the proceeds to supply food to *Brahmans.*

68. An inscription commemorating the self immolation of a manager of the fane at *Sri-rangham* (near Trichinopoly) whose name was *Appana-ayengar.* In consequence of all supplies to the fane being withheld, in a bad time, he ascended the *Rayer-gopura* or lofty tower, and precipitated himself to the ground. The 24th of *Tai* of a cycle year only is mentioned. The precise time of this occurrence cannot be, from the document, ascertained. But possibly it is the incident related by Mr. Orme; and by him ascribed to a somewhat different cause.

69. Dated in Sal. Sac. 1596. Gift of a village by *Chola-nát'ha-nayaker* of the line of *Visvanát'ha-nayaker*, for the supply of food, and for expenses of festival processions.

70. Dated in Sal. Sac. 1172, relative to the fane of *Cholesvara-svami* in the district of *Dharapur-tuccadi.* Gift of a village; by whom does not appear.

71. In Coimbatore. Gift of six elephants, to what place is not specified.

72. Inscription dated in Sal. Sac. 1449. Gift of a village, by whom does not appear. The gift is to a *Vaishnava* fane.

73. In *Dharapuram* district. Inscription, commemorating the gift of a village.

74. Dated in Sal. Sac. 1262, in the time of *Vallálan-dever.* Gift of a village, the reservoir to supply water for washing the image.

75. Dated in Sal. Sac. 1501. Gift of a certain portion of land; the proceeds to supply sacrifices and offerings.

76. Gift of a village, by two persons mentioned, to a fane of *Vara-da-raja.*

77. Inscription, publishing charitable grants at the *Vaishnava* fane of *Mascà*, in the hundred of *Cerunturai* in Coimbatore.

78. At *Dondesvara* fane, in the same district. A record of charitable donations.

79. Gift to Brahmans at *Satyavedamangalam* in the *Cali-yuga* year 1607½ (more probably Sal. Sac. 1607).

80. Dated in *Cali-yuga* 4432. What was given not legible.

81. Dated in the 3d year of *Vira-raja-devan*: the letters of the inscription could not be copied.

82. Dated in Cali-yuga 4632, in the government of *Pilla-rája;* gift of a village, to a fane.

83. Inscription at *Agastes-vara* fane in *Dharapuram.* Dated in *Cali-yuga* 4633, in the time of *Deva-maha-raja.* Gift of cows, and other cattle, by a trader.

84. Dated in Sal. Sac. 1621. Gift of 3 reservoirs, a grove, and fertile land, during the power of *Chitambara-nát'ha-Muthali.*

85. Dated in Sal. Sal. 1421. Gift of land.

86. Dated in Sal. Sac. 1333. Gift of a village, and of a house, for the maintenance of a daily rite of homage.

87. In the time of the *Vallála* king. Gift of a water reservoir.

88. Dated in the 5th year of *Vicrama Chola-dever.* Gift of a garden, well and cows, for the use of a fane.

89. Dated in *Tribhuvana Chacraverti's* reign. Gift of some coins, current at that time.

90. Gift of food for the servants or attendants of a fane by the head-men of a village.

91. A similar donation.

[It appears to me profitless, and uninteresting, to continue so minute a detail, the whole has been carefully examined; but in what follows that only which seems to be a little more special is given].

92. In the time of *Achyuta-rayer* Sal. Sac. 1200: a gift of land.

93. A tabular list of inscriptions; with the date; year of kings' reign; or other distinctive mark; which may be of use to refer to: the number is but small.

94. A paper referring to some modern affairs, in the wars of the south; the names of English officers occurring.

95. A few dates which refer to later periods of rule, than Sal. Sac. 1600.

Remark.—The *materiel* of this book was observed to be in a rapidly perishing condition; and restoration by a copyist was necessary in order to ascertain the value of the contents. This may be judged of from what goes before. My own estimate would be but moderate; though there certainly are dates, and names, that are of use in confirming or correcting other written documents. The book itself will not long continue legible; but the restored copy can be referred to, should occasion so require.

(To be continued.)

VIII.—*Remarks upon Colonel* Reid's "*Attempt to develop the Law of Storms.*"*—By T. G. Taylor, Esq. Astronomer to the Honourable East India Company.

The author commences by stating, that his attention was first directed to study the subject of storms, when employed at Barbadoes in rebuilding the Government offices which had been blown down in the hurricane of 1831; when "1477 persons lost their lives in the short space of seven hours." Pursuing the subject, Col. Reid has collected from various sources, a large connected mass of information; from which it would appear—that the character and disposition of the larger gales of wind, or hurricanes, are not of that casual order that they have generally been supposed to be.

We may mention, that Col. Reid has not exactly proposed a new theory, but in the end, has rather instituted an inquiry into—how far the whole of the facts relative to hurricanes (derived principally from the logs of different ships) may be explained *by a* theory.

Col. Capper, as far back as 1801, had mentioned in his history of storms upon the Coromandel Coast, that "it would not, perhaps, be a matter of great difficulty, to ascertain the situation of a ship in a whirlwind, by observing the strength and changes of the wind. If the changes are sudden, and the wind violent, in all probability the ship must be near the centre of the vortex of the whirlwind; whereas if the wind blows a great length of time from the same point, and the changes are gradual, it

* *An Attempt to develop the Law of Storms by means of facts, arranged according to place and time; and hence to point out a cause for the Variable Winds, with the view to practical use in Navigation. Illustrated by charts and wood cuts.—By Lieutenant-Colonel* Reid, C. B. *(of the Royal Engineers), London,* 1838.

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NATURAL HISTORY

Fig. 1.

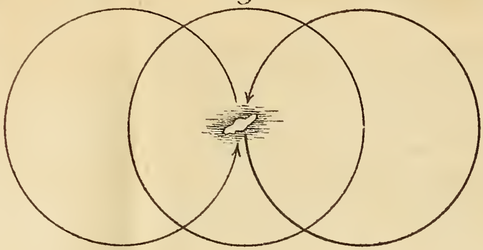


Fig. 3.

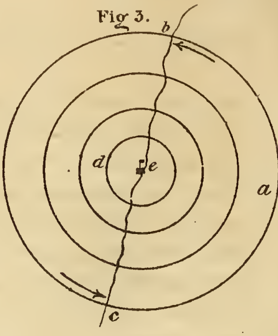


Fig. 2.

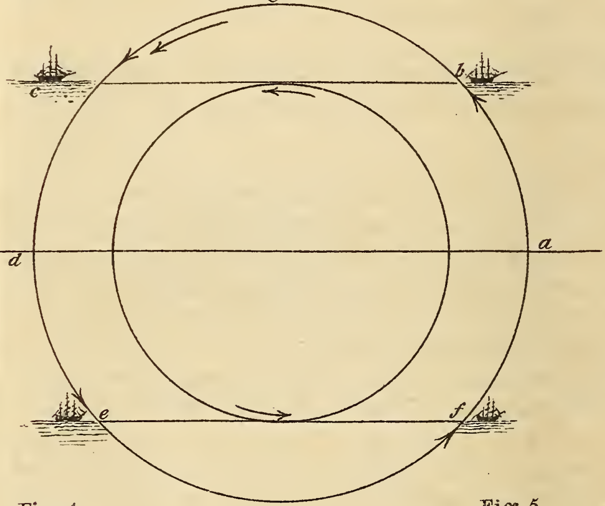


Fig. 4.

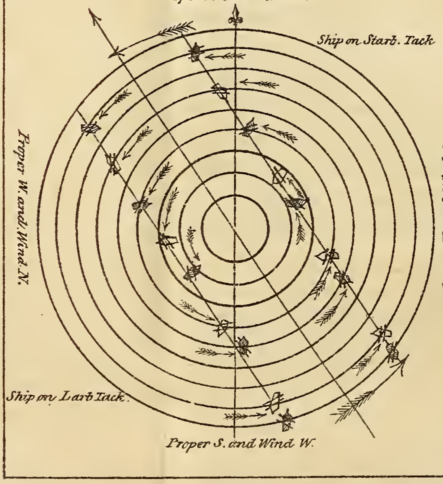
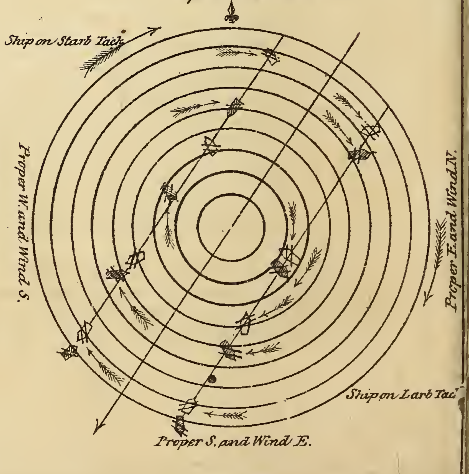


Fig. 5.



may be reasonably supposed the ship is near the extremity of it."* These views too had likewise been entertained by Mr. W. C. Redfield of New York, from a consideration of the storms occurring in the West Indies. On laying down on a chart the position of ships situated at various places within the ranges of several of these storms, Col. Reid found, that "*the more exactly this was done, the nearer appeared to be the approximation to the tracks of a progressive whirlwind.*"

To understand the effect of a progressive whirlwind, it is only necessary to inspect the figures 1, 2, and 3, Pl. 8. In figure 1, the Island, with reference to the circle to the right, would experience a *northerly* gale; and, supposing the storm—the whirlwind—to be travelling towards the left, or due west, the northerly gale would continue, until, by its progressive motion, the island were situated in the centre of the circle, when a calm might be expected; after which, the gale would assuredly set in from the directly opposite quarter (from *the south*); until, having arrived at the position occupied by the circle to the left, the storm would here cease.

If, instead of an island, we consider the case of a ship under sail, the circumstances might be considerably altered; for, were the ship's course the same as that pursued by the storm, it might, by keeping pace with the storm, continue for days within its influence; whereas, by an opposite course, it would in a comparatively short time be got rid of. If the ship were situated at *c*, as in fig. 2: supposing the direction of the whirlwind to follow the course *a b c d*, then, the wind at the commencement of the gale would set in from the N. E.; after which it would shift to the east, and terminate eventually at S. E.: but, were the ship situated in the lower portion of the circle (at *e*), then the wind would set in from the N. W., after which it would shift to the west, and eventually terminate at S. W. If, however, the whirlwind were to follow the direction *d c b a;* the direction of the wind, both at the commencement and end of the storm, would be different: for the upper position (*c*), the wind would in this case commence at S. W.—shift to the west, and terminate at N. W.; and for the lower position in the figure (*e*), the wind would commence at S. E.—shift to the east, and terminate at N. E.

Hence it became a matter of some importance, to learn—if whirlwinds in the southern hemisphere revolved in the same direction as did those in the northern. The investigation was difficult, from the few observations which could be met with in the southern hemisphere; but, on the whole, it appeared that there was no exception to the general rule, *that the whirlwinds in the northern hemisphere all revolved after the order N. W. S. E. (according to the order of the signs); whereas those in the*

* Reid, p. 2.

southern hemisphere all revolved in the opposite direction, or N. E. S. W. (contrary to the order of the signs).

If we could now discover, that the tracks of storms in various parts of he globe, followed fixed laws; for instance—that the tracks of storms on the Coromandel Coast travelled from east to west *always*,—that the Mauritius storms pursued a south westerly course; and that the storms peculiar to the West Indies originated from the east, and, recurving parallel to the coast of America, terminated in a westerly course;—could we be sure that these laws were *always* observed by storms, we should be then in possession of facts, sufficient to enable us to sail in a direction at the commencement of a storm, so as to avoid encountering its worst effects. With regard to the rate of progression of storms, it appears that they are various; being, in some cases, as low as seven miles per hour; whilst others there are, whose velocity has reached forty or fifty miles per hour.

In Col. Reid's work, the tracks of nine storms which have occurred in the West Indies are laid down in a chart. In each of these the course of the several storms has been accurately traced to be from W. by N. to W. N. W., when encountered within the limits of 10—20 degrees of north latitude; after which, gradually curving towards the north, in the 30th degree of N. lat, its course becomes due north: from thence—apparently with perfect symmetry—the curves incline towards the east.

The East Indian gales appear invariably to travel from the coast of Arracan:* towards the west; the curves conforming gradually to the slope of the shore, until in about the latitude of Madras, when their course is due south; after which the curve bends again towards the west, the violence of the storm seldom extending below Cuddalore, or Porto Novo.

The Mauritius and Madagascar storms appear likewise to travel from the eastward at their commencement; but the point of recurving, from want of sufficient observation, does not appear yet to have been clearly made out.—We meet with the following description of the hurricane at the Mauritius in 1818.

" La salle de spectacle est un très-grand édifice. Sa forme est celle
" d'un T dont la tête est un avant-corps considérable, puisque la partie
" postérieure, formant la queue du T, a seule 53 pieds de largeur sur 82 de long. Si cet édifice eût été brisé par la tempête on aurait pu attribue

* The progress of the Madras storms has not yet been correctly ascertained:—the storm of 1836 appeared to come from the eastward direct, but the matter is very doubtful.

" cet événement á la manière dont il était construit; mais, ce qui est à-
" peine croyable, cet immense arrière-corps de 34 pieds et surmonté d'un
" comble en charpente, lié en outre avec l'avant-corps qui forme la
" façade, a cependant chassé de près de cinq pieds sur son soubassement.
" Quelle force prodigieuse que celle qui a pu produire, le déplacement
" horizontal d'une telle masse! son renversement eut été un phéno-
" mène ordinaire; sa translation, si l'on peut employer ce terme, ne se
" conçoit pas."*

In the concluding chapter, we find as follows.

" It is a well known fact, that some parts of the globe are more subject
" to storms than others; and I have throughout this investigation felt
" impressed with the opinion, that the force and frequency of storms
" may have some connexion with the law of magnetic intensity.

" The islands of Mauritius and St. Helena are nearly in the same de-
" gree of south latitude; yet at St. Helena a gale was scarcely ever
" known, and it is said to be entirely free from actual storms. Those
" who study Major Sabine's report on the magnetic intensities of the
" globe, and follow his isodynamic lines which express unity, will find
" them opening from each other in the northern part of the south Atlan-
" tic, and including a space which thus really appears to be the true
" Pacific Ocean of the world. Within this space, on Major Sabine's
" charts, will be found two other lines, marking intensities in decimal
" parts less than unity; and he states that the intensity at St. Helena
" as observed by Captain Fitz Roy, is 0, 84: the lowest denomination
" recorded, and the locality of the weakest intensity yet observed on the
" globe.

" When we examine the lines of the greatest intensity, we find them
" 'approaching each other in longitude 110° and 260°' (100° W.), but
" in different latitudes; for the line of least intensity does not coincide
" with the earth's equator. In the Chinese sea, in longitude 110° E.,
" it is to the north of the equator, proceeding thence in a direction south-
" ward of St. Helena.

" Of the supposed four magnetic poles, the positions of the two in the
" northern hemisphere are the best ascertained. The meridians which
" run through these two poles, run also through the Chinese sea and
" near the Caribbean sea, the localities of typhoons and hurricanes; and
" Major Sabine's isodynamic lines indicate the magnetic intensities so
" strongly marked there, that we are led to the belief that there must be
" some connexion between the magnetic intensity and the force of
" storm."†

* Reid, p. 141. † *Ibid.* p. 415.

The above contains the spirit of pretty nearly all the subjects adverted to in Col. Reid's work. Among the rest, there are suggestions for registering the state of the barometer at the several light-houses at places on this side of the Cape, and for collecting information from the logs of ships which have encountered bad weather, &c. Account of water-spouts—whirlwinds, &c. In furtherance of these wishes I will here mention one objection—which, although not disproving the theory that storms arise from rotatory and progressive whirlwinds—still renders necessary some explanation beyond that of rotation and progression. In England, for several years I had been in the daily habit of noting the indications of the barometer, and on the occurrence of gales of wind, my attention was very particular. I have no memoranda by me at this moment to offer in evidence, but I may mention, that I had invariably noticed—*that the rate at which the barometer rose after gales had reached their climax, was always much more rapid than that it had observed in falling previously thereto;* and, on consulting the observations made at Madras and other places, the same circumstance I find *always* occurs. Thus, during the gale of wind at Madras in 1797, we have the following recorded observation :—

Date.	Barometer inches.	Hourly var.	Wind.	Remarks.
Oct. 25th at noon	30.005	.011	——	Gale of wind.
27th — 2 P. M.	29.465		——	Do. at height.
28th — 6 A. M.	29.819	.022	——	Do. had subsided.

In the gale of wind at Madras in October 1818 :—

Oct. 23d at 8 P. M.	29.80	....	N.	Very high wind.
24th — 5 A. M.	29.50	.131	N.	A violent gale.
24th — 10½ A. M.	28.78		calm	An awful lull.
24th — 12 A. M.	29.28	.333	S.	Hurricane at 11 h.

In the gale of wind at Madras in May 1820 :—

Oct. 8th at 10 A. M.	29.750	....	N.W.	Very strong wind.
8th — 8 P. M.	———	....	N.W.	Strong gale.
9th — 6 A. M.	29.400	....		Gale increasing.
9th — 12 A. M.	29.135	.106	W.	Ditto.
9th — 3 P. M.	28.816		——	Still stronger.
9th — 5 P. M.	28.670	.073	——	Continues.
9th — 9 P. M.	28.5*	.1[23]	S.W.	Gale at its height.
10th — 6 A. M.	29.633		——	Moderate weather.

* This is assumed with reference to the two previous observations, but it appears that no actual observation of the barometer was made at this moment.

In the gale of wind at Madras in October 1836:—

30th at 12 A. M.	29.707	....	N.	Approaching a gale.
30th — 1 P. M.	.586	....	N.	Brisk gale.
30th — 2 ——	.321	....	N.	Do. do. [gale.
30th — 3 ——	.269	....	N.	At times a violent
.... — 4 ——	.111	....	N.	Very violent gale.
.... — 5 ——	28.891	.266	N.	Approaching to a [hurricane.
.... — 6 ——	.625			
.... — 7 ——	.285	.340	N.	Do. do.
.... — 7-45 m. —	.285	.550	N. calm	Approaching a calm. From 7.15 to 7.45 an awful lull.
.... — 8-30 m. —	.725	.302		
.... — 9 ——	29.027		S.	A furious hurricane.
... — 10 ——	.258	....	—	A strong gale.
.... — 11 ——	.415	....	—	Very strong wind.

In Colonel Reid's book there are given several registeries of the barometer during storms, but these having been made on board of ships (which probably occupied different places at the different times of observations) are not available for our present purpose. There is, however, one hurricane (which occurred in March 1836 at the Mauritius), in which the barometer was not only registered on shore, but that too, with more than ordinary care :* thus—

Mean Time.	Barometer inches.	Hourly var.	Direction of wind	Remarks.
March 6 at 6 A. M.	29.220		from S. to E.	Strong and sudden gusts.
		.050		
...... — 8 ——	.120		E.N.E. to S.W. by W.	
		.137		
...... — 10 ——	28.845		Do. to Do.	
		.150		
...... — 12 ——	28.545		Do. to Do.	
		.107		
...... — 2 P. M.	28.330		N. E. to S. W.	
		.037		
...... — 4 ——	28.255		S. by W. moderate.	
...... — 5½ ——	28.235		......................calm.	
...... — 7 ——	28.275	.145		
...... — 8 ——	28.420			

Varying with the barometer, is likewise the intensity of the storm, as will be seen with reference to the above five cases, thus—

Storm observed at			Interval begin. and mid. D. H.	between the mid. and end. D. H.
Madras	in	1797	.... 2. 2	.... 0.16
———	—	1818	.... 0. 5	.... 0. 2
———	—	1820	.... 1.11	.... 0. 9
———	—	1836	.... 0.10	.... 0. 4 or 5
Mauritius	—	1836	.... 0.22	.... 0.11 Doubtful.

* Reid p. 155.

Now the continued occurrence of phenomena of this nature, militates against the theory, "that storms are progressive whirlwinds," or rather—as I have observed before—leaves the theory incomplete: for, we should naturally expect from a whirlwind, that its sectional outline would be circular, and, that the time occupied between the commencement and middle, would correspond with that observed between the middle and termination, whereas we have just found them to stand in the proportion of 2½ to 1. In other respects too, the theory adopted by Colonel Reid has not met with complete confirmation, as will be seen with reference to particulars observed in the Madras storm of 1836: it appears from the little information I was then able to obtain, that the centre of this storm passed over a ship (the Water Witch), at a distance of 780 miles to the eastward of Madras, at ½ past 7 o'clock on the evening of the 29th October—just 24 hours before it reached Madras; exhibiting a velocity of progression of 32 miles per hour: hence, whatever may have been the rotatory velocity of any point such as *a* fig. 3 (call it x), it follows, that, at some place (*b*) to the northward of Madras, a hurricane of the velocity $x + 32$ miles per hour must have been experienced; whereas at a corresponding place (*c*) to the southward, a velocity $x-32$ miles per hour only would have been experienced; or, since x represents the velocity which would be experienced at Madras, it would appear, that the gale must have been 64 miles per hour more rapid—stronger—to the northward of Madras than it was to the southward: whereas, from enquiries made at the time, it appeared that a trifling difference only was experienced. With this view of the subject, it will, perhaps, eventually be found necessary to admit, that the onward progression of storms is propagated by *undulations*, and not by an actual movement of the particles composing the whirlwind:—and, further, with reference to fig. 3—if the smaller circle *d e*, represent the space within which the air was quiescent, the theory would lead us to suppose that at *d* and *e* a similar strength of wind would be experienced; whereas, in the storm of 1836, as well as that of 1813, and indeed in every storm which has occurred at Madras, the wind experienced after the lull, is far more violent than that which preceded it.

In conclusion, I may say for myself, that I have been led to make these remarks, not with a view of finding fault with Colonel Reid's book or his theory, but with an earnest desire of forwarding, to the best of my abilities, what he has so ably commenced.

Madras Observatory:
1*st June*, 1839.

[We have been induced to make the three following extracts from Colonel Reid's book, as a supplement to Mr. Taylor's paper; the first, from the local interest it possesses, as exhibiting the fact that the first observation leading to the new theory was made by a distinguished Madras Officer, from what passed before his eyes here on our own coast; the second, as describing a phenomenon calling for elucidation, which may probably be rendered by some of our readers in the Straits, or by those who voyage thither; and the third, because it explains the useful practical results, which, it is hoped, may spring from the new theory.

Colonel Reid seems not to have been aware of the able meteorological observations made by Mr. Goldingham, late Astronomer of Madras, published in the *Appendix* to the 3d vol. of the *Transactions of the Royal Asiatic Society* and republished in this Journal, No. 12, p. 157.—Editor.]

Colonel Capper's Whirlwinds.—The late Colonel James Capper's opinion, that hurricanes are vast whirlwinds, was formed during twenty years' observation and study of the subject, on the coast of Coromandel. In the preface to his work, published in 1801, he says, that when he first attempted an investigation into the winds in India he had great doubts of success, from the number and variety of them: but as he proceeded, he found that there were many words to express the same thing, and that the hurricane, the typhoon, and the tornado, were but English, Greek, or Persian, and Italian or Spanish names, for a whirlwind.

In classing the winds, he observes, " the tempest is, both in cause and effect, the same as the hurricane or whirlwind; and that the storm, or what the Englishman calls a hard gale, is likewise nearly the same." He also states, that it is a long standing error that hurricanes in India occur only at the changes of the monsoons; and that Dr. Halley must have been misinformed on that subject.

There is this difference in the observations of Colonel Capper and Mr. Redfield, that the former seemed of opinion that all whirlwinds are local and temporary, whilst Mr. Redfield has clearly shown that they are progressive. It is not improbable, however, that some storms are local, and end nearly at the same place where they began.

The accounts of those storms, quoted by Colonel Capper, extracted from Orme's History, all occurred on the coast of Coromandel: but the reports given of the winds, though they show that these hurricanes were whirlwinds, are not sufficiently detailed to enable us to determine their tracks, and from what directions (if they were not local) they came.

The following are extracts from Colonel Capper's work on the winds and monsoons.

"During the siege of Pondicherry, at the time of the N. E. monsoon and on the 30th of December, 1760, the weather was fine in the evening; but a heavy swell rolled on the shore from the south-east. The next morning the sky was of a dusky hue, accompanied by a closeness of the air; but without that wild irregularity which prognosticates a hurricane. Towards the evening, however, the wind freshened from the *north-west*, and at 8 at night increased considerably. About midnight the wind veered round to the *north-east*; fell calm, with a thick haze; and, in a few minutes, flew round to the *south-east*, whence it blew with great violence. Almost all the ships might have been saved, had they taken advantage of the wind blowing off the land: but the roaring of the wind and sea prevented the captains from hearing the signals for standing out to sea. The Newcastle and Protector were driven on shore, a few miles south of Pondicherry, and the crews were saved. The Norfolk, Admiral Stevens, returned next day; and on the 7th came in the Salisbury, from Trinco Trincomalee, south; and the Tiger from Madras, north: so that in these opposite directions, of east, north, and south, the violence of the storm had not been felt.*

"The next in succession was that of 1773; on the 20th of October that year, many days after the north-east monsoon had apparently commenced, the wind began to slacken, and the clouds in the evening appeared uncommonly red; particularly on the day preceding the storm. On the morning of the 21st, a strong wind blew off the land; and, in the course of a few hours, flew all round the compass. At this time the Norfolk, man of war, Admiral Cornish, with the America and Weymouth, and the Princess Charlotte, country ship of 400 tons, remained in Madras roads, with several other country vessels. The wind began to blow from the north-west, and continued from that quarter for three or four hours; of which time the men of war availed themselves to put to sea: but it then suddenly shifted to the *eastward*, and prevented most of the country ships from following their example. After having blown with incessant

* After this went to the Press, I obtained, from the Admiralty, copies of the log books of the Norfolk, the Salisbury, Tiger, York, and other ships of Admiral Stevens' squadron in 1760-1. The storm above alluded to began about N. N. W., and ended about S. S. E.

The Tiger, as well as the Salisbury, York, and Weymouth, were all to the *southward* of Pondicherry; and were, in different places, within the influence of this storm; apparently, showing that this storm came from the direction of the equator, as well as the others, although it must have moved a little southerly at Pondicherry, by the wind veering from N. N. W. to S. S. E.

violence for fourteen hours, and with almost equal strength from every point of the compass, it at length ceased; but literally left only wrecks behind.

"All the vessels at anchor were lost, and almost every person on board perished; but the men of war and Princess Charlotte returned into the roads on the 24th. The former had felt the gale very severely whilst near the coast; but without sustaining any material injury: the latter vessel likewise, from staying rather too long at anchor, had lost her fore and main masts, and was otherwise much damaged."

After accounts of other storms, Colonel Capper continues:—

"Ships which put to sea in due time, very soon get beyond the influence of the hurricane to the eastward; and it is very well known that they never extend far inland. All these circumstances, properly considered, clearly manifest the nature of these winds, or rather positively prove them to be whirlwinds, whose diameter cannot be more than 120 miles; and the vortex seems generally near Madras or Pulicat. Those which happen in the north-east monsoon, generally fall with most violence within a few leagues of this place, and never, I believe, reach south of Porto Novo.

"But at the commencement of the south-west monsoon, violent gales are sometimes felt on the east side of Ceylon, and the southern extremity of the coast."

After describing a hurricane, encountered in south latitude by the Britannia, Indiaman, on the 10th of March, 1770, and explaining that it did not extend above 30 leagues, since the Britannia fell in with two ships which were within this distance, Colonel Capper proceeds:—

"Thus then it appears, that these tempests or hurricanes are tornadoes or local whirlwinds, and are felt with at least equal violence on the sea coast and at some little distance out at sea. But there is a material difference in the situation of the sun when they appear at different places: on the coast of Coromandel, for example, they seldom happen, particularly to the northward, except when the sun is in the opposite hemisphere. On the Malabar coast they rage with most violence during the monsoon, whilst the sun is almost vertical. Near the island of Mauritius, they are felt in January, February, and March, which may be deemed their summer months; and in the West Indies, according to Mr. Edwards's 'History of Jamaica,' the hurricane season begins in August and ends in October."

In Colonel Capper's work, we find Franklin's explanation of what first led him to observe that the north-east storms of America came from

the south-west. It is in a letter to Mr. Alexander Small, dated the 12th of May, 1760, and is as follows:—

"About twenty years ago, we were to have an eclipse of the moon at Philadelphia, about 9 o'clock; I intended to have observed it, but was prevented by a north-east storm, which came on about 7, with thick clouds as usual, that quite obscured the whole hemisphere; yet when the post brought us the Boston newspaper, giving us an account of the same storm in those parts, I found the beginning of the eclipse had been well observed there, though Boston is north-east of Philadelphia about 400 miles. This puzzled me, because the storm began so soon with us as to prevent any observation; and, being a north-east storm, I imagined it must have begun rather sooner in places further to the north-eastward, than it did at Philadelphia; but I found that it did not begin with them until near 11 o'clock, so that they had a good observation of the eclipse. And upon compairing all the other accounts I received from the other colonies, of the time of the beginning of the same storm, and since that, of other storms of the same kind, I found the beginning to be always later the further noth-eastward."

Whilst introducing the above paragraph, Colonel Capper says, it affords us a proof that a current of air in America moved many hundred miles during a north-east storm, probably from the Gulf of Mexico to Boston. Thus, having stated his belief that hurricanes were whirlwinds, he was upon the point of showing also that they were progressive.*

Ripplings in the Straits of Malacca.—A disturbance of the surface of the sea of a different kind has been observed in the Straits of Malacca, which is not easily accounted for; and I shall here insert Horsburgh's description of it, in the hope that it may create inquiry and observation.

"In the entrance of Malacca Strait, near the Nicobar and Achen Islands, and betwixt them and Junkseylon, there are often very strong ripplings, particularly in the south-west monsoon; these are alarming to persons unacquainted with them, for the broken water makes a great noise when a ship is passing through the ripplings in the night. In most places, ripplings are thought to be produced by strong currents, but *here* they are frequently seen when there is no perceptible current. Although there is often no perceptible current experienced, so as to produce an error in the course and distance sailed, yet the surface of the water is impelled forward by some undiscovered cause. The rip-

* Reid, pp. 263-7.

plings are seen, in calm weather, approaching from a distance, and in the night their noise is heard a considerable time before they come near; they beat against the sides of a ship with great violence, and pass on, the spray sometimes coming on deck; and a small boat could not always resist the turbulence of these remarkable ripplings."

Naval officers, who have often seen these ripplings, represent them as being met with out of soundings, and in other localities besides the Straits of Malacca. They are supposed to be circular in form, and of various diameters, from a few hundred yards to a mile. The ripples are obliterated by strong winds, which raise waves on the surface of the sea; but they are distinguished from other undulations by a breeze, which has carried a ship two knots an hour with sky-sails set. If two ships in company meet these ripplings, they might, by heaving-to on opposite sides of the disturbed portion of the sea, observe if there were any circular current. If water-spouts are electrical phenomena, and if the Orontes was carried forward by such a cause, the same cause might give motion to the sea in the manner described, and might agitate its surface.

The great height to which the salt water of the sea is sometimes carried up into the air, whether by the mere force of the wind driving it as spray, or by some lifting motion, as in the water-spouts, deserves attention. That which follows is an extract from the April report from Barra Light-house for the present year (1838), sent me by Mr. Robert Stevenson, the engineer to the northern light-houses.

"On the 16th it rained spray and snow all day; so that for a week after we had no fresh water on the island." And Mr. Stevenson added this note to the report:—"The top of the island, or base of the light-house, is 600 feet above the level of the sea."

It had blown a storm, and the height of the barometer was, according to the same report, as follows:—

April, 1838.	Barometer.	Wind.
Saturday 14	9 A. M. 29.30	S. W. & W. breeze.
	9 P. M. 28 93	
Sunday 15	9 A. M. 28.80	N. W.
	9 P. M. 28.93	Ditto.
Monday 16	9 A. M. 28.94	Ditto.
	9 P. M. 28.96	Ditto.
Tuesday 17	A. M. 29.20	N. N. W.
	P. M. 29.34	North.

Rules for laying Ships to in Hurricanes.—That tack on which a ship should be laid-to in a hurricane, has hitherto been a problem to be solved; and is one which seamen have long considered important to have explained.

In these tempests, when a vessel is lying-to, and the wind veers by the ship's head, she is in danger of getting stern-way, even when no sail is set; for in a hurricane, the wind's force upon the masts and yards alone will produce this effect, should the wind veer a-head; and it is supposed that vessels have often foundered from this cause.

When the wind veers aft, as it is called, or by the stern, this danger is avoided; and a ship then *comes up* to the wind, instead of having to *break off* from it.

If great storms obey fixed laws, and the explanation given of them in this work be the true one, then the rule for laying a ship to, follows like the corollary to a problem already solved.

In order to define the two sides of a storm, that side will be here called the right-hand semicircle which is on the right of the storm's course, as we look in the direction in which it is moving; just as we speak of the right bank of a river.

The rule for laying a ship-to will be, when in the *right-hand* semicircle, to heave-to on the *starboard* tack; and when in the *left-hand* semicircle on the *larboard* tack, in both hemispheres.

Fig. 4, Plate 8, is intended to represent one of the West Indian hurricanes, moving towards the east-north-east, in the direction of the spear drawn obliquely. The commander of a ship can ascertain what part of a circular storm he is falling into, by observing how the wind begins to veer. Thus, in the figure, the ship which falls into the right-hand semicircle, would receive the wind at first about east by north; but it would soon veer to the east, as the storm passes onwards. The ship which falls into the left-hand semicircle, would at first receive the wind at north-east: but with this latter ship, instead of veering towards east, it would veer towards north.

The explanation of the rule will best be made out by attentively inspecting figures 4 and 5. In both, the black ships are on the proper tacks; the white ships being on the wrong ones.

Figure 5 is intended to represent one of those hurricanes in south latitude which pass near Mauritius proceeding to the south-westward. The whirlwind is supposed to be passing over the vessels in the

direction of the spear head. It will be seen that the black ships are always coming up, and the white ships always breaking off; and that they are on opposite tacks on opposite sides of the circles. Thus, the Astrea, commanded by the late Sir C. Schomberg, was on the proper tack on the 20th of March, 1811; and an inspection of the log of that ship shows how gradually she came up; but the Buccleuch, on the 22d of January, 1831, having had the wind from east-south-east, veering to south, and then to south-south-west, thereby proving her to be in the right-hand semicircle of a storm moving southerly, was in the wrong position when laid-to on the larboard tack. Had she been on the other tack, the wind in veering would have drawn aft; then, perhaps, she would not have lain so long "with her broadside in the trough of the sea, and with her lee-waist full of water."

If hurricanes were to move in the opposite course to that which they have hitherto been found to follow, then would the rule be reversed; for the white ships would come up, and the black ships break off.

It can require no comments to point out, that if the wind in storms follows a fixed law, much advantage may be gained by the knowledge of that law.

In following the tracks of storms here detailed, we find that the hurricane drawn on Chart VI. passed over the Island of Antigua in six hours. Yet the ship Judith and Esther, not far from that island, was twenty-four hours in the same storm; for that ship ran along with it; and many other instances of the same nature occur in this inquiry.

If one side of a storm be to a ship in her voyage a foul wind, the opposite side of the same storm would be a fair one. Thus, within the tropics in the Indian Ocean, the left-hand semicircle is a fair wind for ships in their voyages from India to the Cape of Good Hope, whilst the right-hand side will assist the voyages of outward bound ships: but there is this important difference, that in the first case ships would carry the fair wind with them; whereas in the other semicircle, owing to the ship sailing in the contrary direction to the progression of the gale, she would have the benefit of it during a short time only. Thus, if a hurricane coming from the eastward were passing over Mauritius, moving at the rate of ten miles an hour, and a ship sailing eastward were to fall into the side of the storm next the equator, the ship and storm would pass each other in half the time in which the hurricane would pass over the island, since they would be travelling at the same rates, but in opposite directions.

In the 12th edition of the 'American Coast Pilot,' will be found some practical rules, by Mr. Redfield, applicable to ships meeting storms in the North Atlantic, and all I have collected proves that these rules are correct. That a seaman may be able to apply them, however, requires that he should study the subject and understand the principle.

When storms recurve in either hemisphere, and cross the tracks of ships, the practical application of such knowledge as we have gained becomes more complicated. This will frequently happen to ships on their homeward voyage from India, and as they cross the meridians of the islands of Mauritius and Bourbon, about the 25th degree of south latitude. This may be a reason why the neighbourhood of these islands is so much dreaded; for the Mauritius hurricanes, instead of originating there, appear to come from the eastward.

If two ships, one in each hemisphere, were sailing west, and each met storms after they had recurved, the centres of both of which storms were also on the same parallels of latitude as the ships, the vessel in north latitude would meet the wind at south, and that in south latitude would meet the wind at north. Each ship would be most likely to avoid the storm by putting her head towards the equator: but they would be on opposite tacks. The ship in north latitude would be on the starboard tack, the ship in south latitude on the larboard. In both cases the wind would veer towards west, and both ships would come up until the storms passed by them, in their progress towards their proper poles; after which the wind might be variable.

The storm tracks here traced are far from sufficient in number to afford that knowledge of the winds, at which we are now capable of arriving. My object has been to prove, that the subject deserves the attention of abler men than myself, and that we have hitherto studied meteorology in far too confined a sphere. Since our own country is too limited for the comparisons required, nations should combine to study the atmospheric laws. The light-houses along the coasts of the civilized world might exchange their observations for this end. The great steam navigation companies might place their log-books where easy reference could be made to them; and, in the Pacific Ocean, many useful observations be made by the large body of Englishmen settled there as missionaries. A more perfect knowledge of the subject would improve international communication, which it is to be hoped for the benefit of mankind.*

* Reid, pp. 423-31.

IX.—*Special Report on the Statistics of the Four Collectorates of Dukhun, under the British Government.*

(Concluded from our last.)

Irrigation.

Preliminary to speaking of agriculture, it is necessary to state that lands are watered artificially in two ways. First, by conducting streamlets from running rivers or brooks. Lands so watered are called Paatsthul, from Paat, a channel, and Sthul, a field.* These streamlets do not always last through the hot season; and though this species of irrigation, while available, is infinitely less onerous and less expensive to the cultivator, affording also a more plentiful supply of water than the well watering and great returns; yet it is not so certain, and, on the whole, is less permanently efficient than well watering. The second method is by well watering. Lands so watered are called Moht Sthul, from Moht, the water-bucket, and Sthul, a field. There is a good deal of trouble attending this method, and it requires the continual expense of the support of two or four bullocks, the wear and tear of materials, and the keep of one man, who, however, can readily manage two buckets, and two pairs of bullocks: at the same time it requires also a boy in the garden or field to open and shut the different channels. This is the most common method of irrigation in the districts reported on. Usually only two bullocks are attached to each bucket; in some instances, however, where the wells are deep, four bullocks are attached to each bucket. The cattle pull down an inclined plane and discharge the water, and readily walk backwards up the plane to the highest part of it; on the bucket being refilled, they go down the plane again; the driver sings to them and rides down on the rope. The process is suspended for an hour or two during the middle of the day. A very considerable quantity of water is brought up by this method. The buckets in use vary little in size, and the wells, probably, range

* Literally "firm land."

from 25 to 45 feet deep: some experiments of mine, therefore, to ascertain the quantity of water brought up from a well 35 feet deep in a certain time, may be considered as an average of the efficiency of this method of irrigation. I found a moht (of six paahls) average a delivery of 198 wine bottles of water each time. The bottle contained 28 ounces of water, apothecaries' measure, consequently the bucket contained 5544 ounces wine measure, 231 quarts, or 57 gallons 3 quarts. There is a singular uniformity of time between the delivery of two buckets, seldom exceeding seventy seconds: a man and a pair of bullocks, therefore, in an hour deliver 2931 gallons of water; and, labouring seven hours a day, give 20,517 gallons wine measure; and the same man with two pairs of bullocks delivers 41,034 gallons of water; a quantity infinitely exceeding what Europeans usually believe to be drawn up by the simple means employed. At eight pounds troy to the gallon, the weight of water drawn up by one pair of bullocks in one day will be 164.136-lbs. troy; and by two pairs of bullocks, 328,272-lbs. troy. This account appears very considerable, but my experiments have been repeated with care: and, on the whole, the delivery of water may be rather underrated than overrated.

Near the village of Piroorgoot, I observed a simple method of watering a field. The bed of a nullah, or rivulet, with very low banks, had been dammed up; three pieces of wood, like a gin, were put over the water; a scoop was suspended by a rope to the apex of the gin, and a man scooped out the water into his field. The labour was great, and the supply of water small. This apparatus is called Dohl.

It would appear to be of considerable importance to encourage the making of wells, as the only means of increasing the very limited exports of the Dukhun.

Agriculture.

Some general observations will be necessary, as the crops and agricultural process in the Mawuls* differ materially from the crops and agricultural process in the Desh.† The principal crop of the Mawuls is that of the rains, and the most valuable of its produce is rice. The severe labour attending the preparation of the rice ground in the hot weather is great, and in the rains the cultivator has to trample up to his knees in water and mud ploughing the rice field, probably in a deluge of rain, but

* Hilly districts along the crest of the Ghàts.

† Flat country, eastward of the Mawuls.

with his head and back most securely protected by the Eerluh,* however much exposed the rest of his body may be. The transplantation is performed under similar exposure. The other monsoon grains of the Mawuls are the Sawa, Wuree, and Natchnee, and Karlee, or Kalee Teel† which is an oil plant of the only other monsoon product.

The labour attending the cultivation of these grains, in a very unfavourable climate, at the time they are grown, falls very severely on the people, but they are compensated for their labour and suffering by good returns of that valuable produce rice; and the returns of the other grains are great, and the crops seldom fail.

The Koonbees, or farmers of the Mawuls, also have an advantage which those of the Desh are not always assured of, i. e. the certainty of finding a market for one of their products, rice.

Dry Season Crop (Mawuls).—The dry crop of the Mawuls does not call for any mention in this place.

Dry Season Crop (Desh).—With respect to the Desh, the most valuable is the Rubbée, or *spring* crop‡. The agricultural processes in both crops is certainly defective, less owing to the ignorance of the cultivators, who are well aware of the advantage of a ploughing adapted to the character of the soil, of good manuring, complete weeding, rotations of crops and fallows; than to their necessities, which compel them to rack their land; they cannot generally afford to purchase a sufficiency of manure, they have not any stable-yards, and the dearth of fuel compels them to burn much of their cow-dung; and, with a singular fatuity and injurious caution, they sow half a dozen grains and pulses together in the same field, which necessarily impede the growth of each other, exhaust the soil, and give limited returns. The professed object is to assure, in the occasional uncertainty of the monsoons, some kind of return at least for their labours, which might have been wholly unproductive had one grain only been sown. In short they want to have half a dozen strings to their bow instead of one.

Wet Crop (Desh).—The grains so sown ripen in succession, and two of them remain on the ground between nine and ten months; that is to say, from the beginning of June to the end of February. In their management of the plough, the Koonbees do not want dexterity. Their cattle have all names, know their names, and are obedient to them; with four bullocks to a plough, the leaders are guided entirely by the

* Eerluh, or basket-work hood, covered with leaves and quite impervious to rain.

† Wet season crop (Mawuls).

‡ Consisting of wheats, gram, barley; Shaloo, (*Andropogon Saccharatum*); Dhal, (*Cytisus cajan*), oil-plants, &c.

voice, and I have frequently seen quite a youth managing alone very cleverly his plough and four bullocks.

In the Desh, in manuring land, the cart called *Jang* or *Janj-eea*, is used ; it consists simply of the common cart with a quite flat basket tied on the top of it, made by the Koonbees from the twigs of the Neergoondee, (*Vitex trifolia,*) or of the twigs of the Tooree, (*cytisus cajan*). The manure generally consists of the sweepings of their houses, which, from being usually cow-dunged every day and daily swept, are not trifling, and from the ashes also from their hearths.

Crops are carted to the *Kulleh*, or farm-yard, from the fields by the Garra. This consists of an upper horizontal rude frame-work supported on a thick axle-tree, and is removeable at pleasure. The wheels are of solid wood, small, placed under the frame-work, are not sufficiently far apart, and consequently subject the cart to upset, which is but too frequent an occurrence. Wooden pegs and thongs keep the whole vehicle together, and there is no more iron about the cart than the tire round the wheels and the hollow cylinders within the naves. This vehicle, considering the circumstances of the Koonbees, is expensive, costing from eighty to one hundred rupees, and it is only the most substantial among them who have carts. Having carted their grain, the Koonbees remove it to the Kulleh, or farm-yard.

Farm-yard.—The grain is stacked round a spot in the open air in a corner of one of their fields. This spot is circular, and has been prepared by beating and cow-dunging ; a pole, called *Tewrah*, is fixed in the centre of it. In the reedy grains the heads are broken off by women, and strewed round the pole* to the depth of 5 or 6 inches. In the ligneous pulses, the extreme twigs, bearing the legumes, are broken off and strewed round the pole ; and in the herbaceous leguminous pulses and straw-culm grains, the whole plant is put on the floor : six, or eight, or more bullocks (I saw sixteen at Munchur) are tied side by side, half on one side of the pole and half on the other ; they are muzzled and driven round the pole, treading out the grain. This process usually occupies two men, and it is called the *Mullnee*. It is neither inefficient, nor dilatory. It would appear to be of great antiquity, and widely practised ; in Deuteronomy, xxv. 4- we read, " Thou shalt not muzzle the ox when he treadeth out the corn."

Winnowing.—We are now brought to the winnowing the grain. This is done in the Kulleh ; and when there are sufficient members in the family of the farmer after the first treading, the process is carried on simultaneously with the Mullnee. The process is very simple, but cer-

* Tewrah.

tainly not very efficient, as it is dependent on the wind blowing. In case the wind blows very hard, the grain is blown away; and in case the wind is not strong enough, the husks fall with the grain. A man stands upon a tall three-legged form, called the *Wawhree*, and pours the grain taken up from the treading ground, out of the winnowing basket (*oopunwutee*). The full grain falls perpendicularly and is pretty free from husks, but the lighter grain falls obliquely, and is partially mixed with the husks. A man sits at the base of the stool or form with a broom (*aatuee)* in his hand to assist in removing the chaff from the edges of the mass of fallen grain. After all is done, however, it is requisite to pass a good proportion of the grain through the sieve (*Chalun*). After the grain is winnowed it is carried home and laid in store.

Preserving Grain.—There are various ways of preserving the grain. Where the soil is sufficiently dry, chambers are dug in the earth for it; but the most usual plan in the districts is to preserve it in large baskets, called Kuneeng, made of twigs of the Neergoondee, (*Vitex trifolia*,) or of those of the Tooree, (*Cytisus cajan*). These baskets are plastered with cow-dung inside and out, and are perfectly impervious to rain or damp. Where the habitations are sufficiently large, or the baskets few in number, they are lodged in the house, but not unfrequently are placed outside of the house within reach of any pilfering hand. A few stones are put under each basket; the lid, in case it has a lid, is sealed down with cow-dung, and in case it has not a lid, a plaster of cow-dung a couple of inches thick is put over the grain; a little cap, or roof of grass, is put over the basket, and it is left exposed till required, being deemed equally protected from the elements and man. In the Mawuls, in the hot months, the whole of the grain baskets of the village, full of grain, may be seen assembled in front of the village, temple, and left to the custody of the village god. The roofs of all the houses are of grass in the Mawuls, and the dread of fires (the people having no chimneys to their houses) induces them to put their monsoon and winter stores in a place of safety, the extreme dryness of the period rendering accidents by fire frequent. It is not an unfrequent practice with the Koonbees of the Mawuls to unroof their houses for the months of April and May.

In addition to the baskets for the preservation of grain, earthen jars, called *Kothee*, made by the people themselves, are met with to hold grain, but they are not common.

Preparing Grain for Food.—The preparation of grain for food is the last process. Husk grains, such as rice, Wuree, *(Panicum miliare)*; and Sawa, *(Panicum frumentaceum)*; and the Johr, or husked wheat, require to be pounded to remove the husks. This process is entirely

within the province of the women: the implements used may be called the pestle and mortar; the mortar is called the ookul, and the pestle, moosul. The mortar in the Mawuls is frequently very rude in form, being a rough stone with a hole scooped in the middle of it to receive the grain. In the Desh, however, the mortar is of wood, of a good form, and sometimes carved. The *moosul*, or pestle, is always of wood, four or five feet long, tipped with iron, and in thickness and weight suitable to the strength of the person to use it. The final process is the grinding the corn; this also is the duty of the women, and two of them are usually employed at the mill. Christ says, "There shall be two women grinding at the mill;* one shall be taken and the other left."

Hand Mill.—The mill is portable, and is called Jatuh: it consists of two flat circular stones, fourteen or eighteen inches in diameter, placed one on the other; the lower one has an upright peg in it, the upper one has a hole in the centre through which the peg of the lower stone passes, and the upper stone is made to perform an horizontal rotatory motion round the peg by means of another upright peg near its margin. The grain is put in at the hole in the centre. This form of mill must be very ancient, for I saw remains of such mills in the ruins of Pompeii, and one nearly perfect in the ruins of the Roman villa of Sir William Hickes's estate near Cheltenham, Gloucestershire.

Raw Sugar Mill.—Under the head of agriculture it will be necessary to speak of the Gool, or raw sugar-mill. Sugar cane is not so much cultivated as it might be, and it is seldom found but at populous villages. I have seldom seen more than two mills at a village; and as the screws and accompaniments are somewhat expensive for the circumstances of a cultivator, the mills are seldom found belonging to him, but he is a renter of them for the term requisite. The mills are in the open air, and consist of two vertical screws which are sunk in a square chamber excavated in the earth; one of them is moved by a double lever so much elevated above the level of the field as to admit of bullocks being attached to the ends of the lever. The cattle go round incessantly in a circle and work the mill. The bits of sugar cane are passed twice between the screws, and the juice runs out into a wooden or copper vessel placed to receive it. The fire-place (Choolangun) and great iron pan (Kurhuee), to boil the juice in, are close at hand; a ladle to stir and skim the juice as it boils, and some circular holes in the ground to receive the juice when sufficiently thick, complete the material and close the process. The work is continued night and day till the cane-field is exhausted. Sugar is not refined in the Dukhun.

*Matth. xxiv. 41.

Oil Mills.—Although the oil mills belong to a class of persons who are not agriculturists, the Koonbee is quite dependent on them to turn his numerous oil seeds to account; some mention therefore of them is necessary under "agriculture." The body of the mill is generally of stone, and the machinery, even when of the rudest construction, shows a good deal of ingenuity and an acquaintance with some of the mechanic powers. It is entirely the work of the village carpenter.

At Neelsee, a Kohlee village in the wilds on the brink of the Ghàts, the body of the mill is of wood, the lever works in the hollow of an upright cylinder, and by the great weight attached to its upper end constantly presses against the sides of the hollow and forces the oil from the seed which is put into the mill. The whole expense of the machinery of this particular mill was only five rupees*. In the Desh the body of the mill is of stone, the machinery is the same as in this mill. It is worked by a bullock.

Average Size of Farms.—There are not any farms of large size under the management of a single farmer; the largest I recollect meeting with was about 200 acres, but in general they average very considerably less in size. In the Poona Collectorate the average size was 29 beegahs†, in Ahmednuggur 35 beegahs, in Dharwar $43\frac{6}{100}$ beegahs, and in Khandesh $23\frac{68}{100}$ beegahs. The average rent of a farm in Poona was less than 48 shillings per annum; in Ahmednuggur about 86 shillings; in Dharwar 64 shillings; and in Khandesh, where a good deal of the land cultivated is garden land, 74 shillings per annum. In Poona the average rent per beegah is within a fraction of two shillings; in Ahmednuggur about two shillings and six pence per beegah; in Dharwar not quite eighteen pence; and in Khandesh, where there is proportionably a good deal of garden land, it is somewhat more than three shillings a beegah. The average for the whole of the lands of Dukhun is two shillings and ninepence, one-eighth per *English acre*, or one rupee and fourteen reas per Dukhun beegah.

Proportion of Yoke Cattle to each Farmer.—Generally in the population returns there were great omissions of the draft or yoke cattle of the cultivators; no very satisfactory statement can therefore be given of their agricultural means in this kind of stock. In one Talook, or county of the Dharwar Collectorate, the yoke cattle were filled in, with the exception of two or three village returns, and the proportion is only 1·33 bullocks to each cultivator; but as the ploughs are 3733 in number in the Talook, at two bullocks to a plough, the proportion should be 2·89

* About ten shillings.

† The Dukhun beegah is three-fourths of an English acre. The rupee is valued at two shillings.

bullocks (nearly 3) to a cultivator: the returns must be defective, for I am satisfied, although a farmer may not have two bullocks to each of his ploughs, and he has generally a heavy plough and a light one, yet he has always two bullocks at least for one of his ploughs.

In the Ahmednuggur Collectorate the yoke cattle are not distinguished from the pack or carriage cattle, but the whole amount is very considerable, being 212,008. In the Poona Collectorate the returns give 2¼ yoke bullocks to each farmer, but the farmers near to the city of Poona are much better off, averaging 3½ bullocks each. Only a portion of the returns from Khandesh had the column of draft or yoke cattle filled up: it is impossible, therefore, to give the proportion to each farmer for the whole collectorate; but as far as the returns went, it appeared that each farmer averaged only 1·62 bullocks, not quite 1¾.

Milch cattle.—The proportion of milch cattle, on which so much of the comfort of the people depends, whether rural or urban, in the Dharwar Collectorate, is greater than in the other collectorates, being one cow or milch buffalo to 2·45 souls. In Poona it is 1 to 5·24 persons: in Ahmednuggur 1 to 3·04 persons; and in Khandesh 1 cow or buffalo to 2·26 souls.

Ploughs.—As I have before stated, ploughs are of two kinds, the Nangur or heavy plough, and the Hulka Nangur or light plough; the same obtains with respect to drill ploughs, no grain being sown broadcast, the heavy drill plough being called Mogurb, and the light Pabhar. The proportion of ploughs in the Dharwar Collectorate is 1·41 to each cultivator, or nearly three ploughs to two farmers; the number of ploughs in the returns being 99,883, and the number of cultivators 70,488.

Carts.—Were a judgment to be formed of the state of the roads, and of the facility of communication and transit by wheel carriages, from the proportion of carts to the farmers, the estimate would be low indeed.* In the Dharwar Collectorate there is only one cart to thirteen farmers. The carts are universally of two wheels.

Pack Cattle.—The unusual number of pack bullocks, which carry loads on their backs, in the Dharwar Collectorate, would seem to indicate that they are the chief means by which agricultural and other produce is transported from place to place. In Khandesh there is the least number of pack cattle, and the greatest proportional number of carts. In Poona a great number of pack cattle, and only one cart to eleven farmers. The proportion in Ahmednuggur I do not know.

* It is nevertheless true, that had the farmers carts, they could rarely use them from the want of roads, unless in the dry season.

Land and other Tenures,

Lands are held under a great variety of tenures in Dukhun, some by virture of offices which are hereditary, some as hereditary freehold property, some in free gift from the state, some in Jagheer or military or feudal tenure, some on a quit rent, and in many other ways; but a rapid notice of the different tenures, and of the office-bearers holding lands, will best assist to give a clear idea of their quality and number.

In the first place, the proprietary right of the soil was (and is) in the people, and not in the sovereign. The sovereign could assess the land as he pleased, and assign away a part of the whole of the revenue arising from the land-tax or assessment, either in free gift (Eenam), military tenure (Jagheer), or quit rent, or in any other way; but he could not *justly* take away a man's land either for his own purposes or to give it to others; although, as a despotic prince, like all other princes of India, he had the undoubted *ability* to do so at his pleasure: yet few instances are known of this oppressive exercise of their power, and there are many instances on record of their purchasing land from their subjects. I have laid before the public translations of official documents, in which the sovereigns have been parties, containing the most irresistible proofs of the people having the uncontrolled right to dispose of their lands as they pleased, by gift, or sale, or devise, or in other ways. These translations are too lengthened to be introduced in this report, but they will be met with in the Journal of the Royal Asiatic Society of Great Britain and Ireland.

All lands in Dukhun were classed within some village boundary or other; and to this day these boundaries are guarded with such jealousy by the inhabitants as to be productive of broils and bloodshed on their slightest invasion. The village lands were divided into family estates, called Thuls, which bore the name of the family, and the estates bear the name to this day, although the family be extinct or Gutkool, as it is called; and half the estates in Dukhun are now Gutkool, but preserve their family names. These estates were hereditary and freehold, burthened only with the sovereign's land-tax, and assessments for village expenses, as a gentleman's estate in England is burthened with land-tax and assessments for highway and poor-rates, &c.; there were not any tithes, but in each village there were lands assigned for religious objects, either to temples or to sacerdotal persons. Every village had a constitution for its internal government; it consisted of the Pateel or chief, assisted by a Chowgulla; the Koolkurnee, or village accountant, kept the village records and details of assessment and revenue; and there

were twelve hereditary village officers, the well-known Bara Bullooteh, whose numbers were complete or otherwise as the population of the villages was capable of supporting them. All these officers and the chief land-owners formed a village council, called Pandreh, which managed the external and internal relations of the village, whether with respec tto raising the government assessments, managing its police, or in settling civil disputes, excepting in cases where Panchaeits or juries of five persons were specifically appointed to arbitrate by mutual consent of the litigating parties. And it is somewhat remarkable that this isolated and internal government has withstood the shocks of all the changes of dynasties, invasions, rebellions and the destructive anarchy which have so frequently disgraced the annals of India.

A certain number of villages constituted a Naikwuree, over which was an officer with the denomination of Naik. Eighty-four villages constituted a Deshmookee, over which was an officer called a Deshmook, or governor,* possibly equivalent to our lord-lieutenant of counties; this officer was assisted by a Desh Chowgulla; and for the branch of accounts there was a Deshpandeh or district accountant and register. The links connecting the Deshmooks with the prince were Sur-Deshmooks, or heads of the Deshmooks; they were few in number. It is said there were also Sur-Deshpandehs. The Sur-Deshmooks, Deshmooks, and their assistants, Naiks, Pateels, and Chowgullahs, indeed all persons in authority, were Mahrattas: the writers and accountants were mostly Brahmans. Such was the state of things under the ancient Hindoo governments. The Moosulmans on their conquest, in the civil divisions of the country, introduced the terms of Soobeh (a province), Pergunnah (county), Tallook (manor, lordship), and Turruff (a division of a county). The Hindoo hereditary officers were deprived of their authority, (excepting those in the village constitution,) but, very liberally, they were not deprived of their tenures; and their places were supplied by Zemindars,† Maamlutdars, Sheristehdars, Havildars, &c.

I have stated that the family estates were called Thuls, from the Sanscrit *Sthul*, "firm land;" and in case the family became extinct or Gutkool, from the Sanscrit *Gut*, "gone, passed away," and *Kool*, "a race or family," the property did not pass to the sovereign, but it was at the

* Called also Desaee or Deshaee in some parts.

† Mistakes, very serious in their consequences, have been made with respect to the supposed rights of Zemindars. They were introduced by the Moosulmans, superceding the ancient Hindoo Deshmooks and Desaees, and were government officers for the collection of the revenue, and for the civil government of districts. In Bengal, the British considered them proprietors of the soil, and constituted them as great freeholders; sweeping away the village freeholds.

disposal of the Pateel solely, or the village corporation conjointly, to do as they pleased with it; and I have multiplied proofs in my possession of freeholds having been created in such estates of extinct families, by letters of inheritance, called Meeras Putra, which were granted by the Pateel or village authorities for a sum of money; and such letters became title-deeds, similar to those of an estate in England. The law of succession by primogeniture not obtaining amongst the Hindoos, these estates became necessarily much divided, and the individual holders were called by the Hindoos Thulwaee or Thulkurce; and the light in which the Moosulmans looked upon such proprietors, when they took possession of the country, is sufficiently manifest by the term they applied to them, namely, Meerasdars, or patrimony-holders, from the Arabic word *Meeras*, "patrimony," "heritage," and *Dar*, "a holder;" and this is the term by which such proprietors are distinguished at the present day. The Meerasdars were of two kinds; the descendants of the original proprietor, whose *surnames* and the name of the estate or thul were identical, and those who had obtained a share of the estate by purchase or otherwise, whose surnames were not the same as that of the estate. In no instance, that I am aware of, have the former class documentary proofs of their right; with the latter class documentary proofs are not uncommon.

There is further proof of the Moosulmans having acknowledged hereditary rights in the term they applied to the Deshmooks, Desaees, Deshpandehs, and others, namely, Hukdar, *Huk*, in Arabic, meaning "right," and *Dar* "a holder;" these persons in virtue of their offices having lands in tenure and fees in money and kind in the districts in which these duties lay. The Meerasdars considered that they might be temporarily dispossessed of their freeholds in case of non-payment of the government assessments and dues, but they claimed to resume them whenever they had liquidated their debts; and they did not consider the question of these freeholds compromised by the government doing justice to itself, any more than the existence of freehold property would be questioned in England because the owner might be compelled to yield up his property in payment of arrears of land-tax, poor-rates, &c.

Meerasdars.—Meerasdars set a very high value upon their lands, and they clung to them with that feeling of personal and family pride which are characteristics of freeholders in Europe; even under the most grinding oppressions of their own government and its local officers, it was only when driven to despair that they abandoned them. The Meerasdar had to pay the government land-tax, all fees in kind to the district and village officers in common with the tenant at will or leaseholder; more-

over, he had to pay a tax applicable to himself only, called Meerasputtee, a kind of smart-money for the distinction his freehold gave him; this was levied every third year. Such was the Meeras tenure of land. His advantages were, first, the distinction; next, his being a constituent of the Pandreh, or village corporation, which the mere renter was not; and thirdly, in some parts of the country where such taxation existed, he was exempt from marriage fees, widows' marriage fees, buffalo tax, hearth tax, and he may have paid a diminished per centage, in the rights of district officers levied in kind. Of late years, from the low prices of agricultural produce and the comparatively heavy money assessments, Meeras-land has scarcely had a saleable value. The terms Meerasdar and Wuttundar have usually been considered identical, but in some village papers I observed them classed separately; and, on asking for an explanation, was told that the Wuttundars were hereditary office-bearers, or the relations of hereditary office-bearers with the possible right of succession, whilst the Meerasdars were merely hereditary landholders: a Wuttundar would necessarily be a Meerasdar, but a Meerasdar was not necessarily a Wuttundar.

Oopuree.—From the extinction of numerous Mahratta families who were in possession of estates, a considerable portion of the land in Dukhun is without proprietors, and much of it is rented to Oopurees or annual tenants by the Pateel or village corporation, under native governments; but, under the British government, by the collector or his officers. The term Oopuree means "a stranger," or a renter of land in a village in which he has not corporate rights: of course, Meerasdars can let their lands to each other, but they do not become Oopurees. The Oopuree holds his lands on the Ooktee, or word-of-mouth tenure, which is a verbal agreement for one year.

Kowl Istawa.—The third tenure is that of Kowl Istawa; *Kowl* means a contract, and *Istawa* is applied to lands let under their value. In practice, to induce cultivators to break up land that has long lain waste, a lease is given of three, five, seven, or nine years; the first year a trifling rent is fixed, and it is annually increased, until in the last year of the lease the full rent is paid; this tenure is highly desired, and great abuses exist under it: the permanently assessed cultivator is prompted to quit his village, and abandon even his hereditary lands, and get Kowl Istawa lands in another village: and the moment the favourable lease is up he changes his location, and endeavours to obtain similar terms elsewhere: the practice, therefore, is detrimental to the permanent revenue, detrimental to the sound advancement of agriculture, and detrimental to the cultivator himself in encouraging vagrant habits. The local authorities also are found to be great occupiers of Kowl Istawa lands.

Owand tenure.—Any inhabitants of a village, cultivating lands in a neighbouring village, but not residing in that village, do so on the Owand tenure. The rate and terms are the Ooktee, and with respect to the village such cultivator is, in fact, an Oopuree, but his distinctive appellation is Owand-Kuree.

The above are the tenures on which the government land revenue is raised, which in the four collectorates of Dukhun amounts to 82·372 per cent. of the whole revenue ; this per centage, however, includes some trifling rents from government lands, gardens, orchards, grass lands, and sheep grazing, quit rents, fees, Hukdars, and extra cesses.

Tenures involving alienations of lands.—I have now to speak of tenures which involve alienations of lands, from a few beegahs in a village, to whole districts : these are *Jagheer* and *Eenam* in Khandesh ; *Surinjam*, *Eenam*, and *Doomalla* in the Ahmednuggur Collectorate ; *Eenam*, *Surinjam*, and *Eesaphut* in Poona ; and in Dharwar, *Jooree Eenam*, *Surwa Eenam*, and *Jagheer* : at least, such terms appeared in the population returns sent to me, and in the public papers which I have.

Jagheer.—Jagheer, which is a Persian word in its orign, is applied to lands given by government (or the government share of the rents) for personal support, or as a fief for the maintenance of troops for the service of the state : some service is implied in the personal as well as in the military Jagheer. In the Collectorates in Dukhun upwards of 400 populated villages appear to be alienated in Jagheer.

Eenam.—Eenam is a word of Arabic origin, meaning a " gift," " present ;" and lands so held should be entirely free from tax to government ; but a subsequent explanation of various tenures will show that Eenam has a much wider signification than is generally supposed. This tenure is very extensive in Dukhun ; for independently of the grants of whole towns and villages to individuals, of which there are 231 alienated in the Poona collectorate alone, and the other collectorates have a proportional share ; independently also of grants for temples and religious institutions, almost every village has Eenam land held by the Pateel, Koolkurnee, and Mahrs, and very commonly the Deshmooks and Deshpandehs have also land rent free appertaining to their offices in the villages of their districts. The Bara Bullooteh, or twelve village artizans and officers, have often Eenam lands, but their Eenam is qualified by the imposition of some professional service, and it pays also a quit rent. Many of the Eenams are very curious in their objects ; for instance, at the village of Wangee, Pergunnah Wangee, Poona collectorate, 15 beegahs of land to a mendicant for reading stories before the goddess Dawai at her festival ; 15 beegahs to the tabor players at the temple ;

30 beegahs to the tumbling and dancing women at the temple; the clarionet and double-drum players had respectively similar Eenams: the gardener, for the supply of flowers, had 30 beegahs, or 22½ acres. These Eenams existed untouched under the bigoted Moosulman government, and still remain.

Surinjam.—Lands held in Surinjam involve the condition of military service: the term is of Persian origin, meaning "furniture," "apparatus," implying that the lands are to defray the expense of equipment: in fact, Surinjam is synonymous with military Jagheer. In the Poona Collectorate 181 villages appear to be alienated in Surinjam.

Doomalla.—Doomalla, in the etymology of the word, means "two rights" or "properties," from *Do* two, and *Maal* property: the term is only found in the list of villages of the Ahmednuggur Collectorate, applied to villages and lands granted to individuals, on which government has a reserved right. In this sense the tenure appears to be that of quit rent, and the term is synonymous with the Jooree Eenam of the Dharwar Collectorate. In the Ahmednuggur Collectorate 581½ villages appear as Doomalla, but this, no doubt, includes Jagheer and Eenam villages.

Eesophut.—In the Poona Collectorate the term Eesaphut is applied to 37½ villages: it is probably a corruption from the Arabic *Zeaphut*, meaning "feast," "entertainment." Lands so held are rent free, and may have been given to assist in celebrating festivals.

In the Dharwar Collectorate the terms Jooree Eenam, Surwa Eenam, and Jagheer occur: the first corresponds to the Doomalla of Ahmednuggur, and is, in fact, a quit rent tenure; the second means "all gift," from *Surwa* "all," and *Eenam* "gift," there not being any tax or fee upon these lands: Jagheer has been explained before.

Tenure of Deshmook and Desaee.—It is a general belief that these officers were coeval with the establishment of the land institutions of the Mahratta people.* Deshmooks were the civil governors of districts, collectors of the revenue, and executive officers of the government. The name is probably a corruption of the Sanscrit *Deshuk*, a governor or ruler. In early times they were exclusively Mahrattas, and not Brahmans or Moosulmans. The importance of the office is attested by the fact that, in the earliest mention of the chiefs of the present great Mahratta families, they are styled *Deshmooks* of such and such districts. Their rights were hereditary, and saleable, wholly or in part, like those of every other hereditary office or right: the right of alienation

* I mean, of course, long antecedent to the Moosulman invasion.

is proved by different casts being now associated in the office. At Ahmednuggur a *third* of the Deshmookee belongs to a Brahman, and *two-thirds* to the ruling Mahratta family at Nagpoor. Similar instances are very numerous. In some cases a Deshmook is also Pateel of one of the villages in his district. The rights and emoluments of the Deshmook are very extensive, but not uniform throughout the country; they had a per centage on the revenue varying from one to five per cent. In the Poona Collectorate the mean charge for Deshmooks and Deshpandehs amounted to 3·06 per cent. of the *gross revenue*, but on the *nett revenue* it amounted as nearly as possible to six per cent; although these persons are now *non-efficient*, their authority being superseded. As a single illustrative instance, it may be as well to state, that at the village of Ankoolsur, Talook Ahmednuggur, out of a village revenue of 4533 rupees, the Deshmook received 265 rupees, and the Deshpandeh 150 rupees; the former sharing 5·84 per cent., and the latter 3·31 per cent. Their next advantage is in some of them enjoying villages in free gift; the third, in possessing Eenam land in most of the villages in their districts, sometimes to a large amount. At Mohol Talook Mohol, the two sharers in the office of Deshmook have each 450 acres of free (or Eenam) land. The fourth right of the Deshmook is a portion of grain from each village, called *Googree*, from all the land under cultivation. In addition to the above, from some villages they were entitled to a sheep and some butter annually; from some villages a dress, from others a turband, and where sugar-cane was cultivated, they had a portion of the raw sugar. They possessed the above advantages on the tenure of executing the duties previously stated. They were to a district what a Pateel is to a village.

Deshpandehs.—The Deshpandehs are contemporary in their institution with the Deshmooks; they were the writers, accountants, and registers of districts; they were always Brahmans. The terms appear to be derived from the Sanscrit *Desh*, country, and *Punnah*, to do business. They were to districts what Koolkurnees were to a village: they had, and have nearly the same rights and emoluments as the Deshmooks, but in a diminished ratio of from 25 to 50 per cent. The offices of Deshpandeh and Koolkurnee are sometimes found united. Their duties are in abeyance, but, like the Deshmooks, they enjoy their rights.

Pateel.—The next and the most important tenure of all is that of Pateel or headman of towns and villages. Pateel is a Mahratta term, and may be derived from the Sanscrit *Puttruh*, "deed," "lease," the Pateel anciently having had the disposal of all vacant lands in his vil-

lage by deed or lease. Originally the Pateels were Mahrattas, but sale, gift, or other causes have now associated in the office various casts, and there are sometimes six or seven or more sharers in the office,—Brahmans, Mahrattas, Moosulmans, Shepherds, Lingaeets, &c., and these not holding in equal proportions. I have elsewhere* given a translation of a very remarkable and curious Mahratta document, proving in the most distinct manner the right of the Pateel, not only to sell his family, or hereditary property, and the lands he held in virtue of his office, but also the lands of extinct families, and his other emoluments and advantages ; but, in doing so, he also alienated part of his dignity, rights, and authority as Pateel : the honours went with the lands. The rights and emoluments of the Pateel are very numerous ; free land, fees of grain on the cultivation, called googree, presents on investitures, on granting letters of inheritance, on marriages; annual presents from the shoemaker of shoes, from the potmaker of pots, from the shopkeepers of cocoa-nuts, &c , market fees, *all the sheeps-heads offered in the temple of Dawai !* daily service, and supply of wood and water by the Mahr and the potmaker ; precedence in all religious or other festivals, in communicating with government, and with others. The details of the translation before noticed show with what jealousy the Pateel maintained all the minutest rights and dignities. Of such importance and so profitable was the office, or in such estimation was the dignity of Pateel anciently, that princes of the Mahratta empire established themselves wholly or in part in the office in various towns and villages ; *Holkur*, for instance, at Munchur ; *Seendeh (Sindiah)*† at Jamgaon ; the Nagpoor *Bhosleh* at Ahmednuggur, and *Powar* of Dhar at Multun and Kuweeteh. There are traditional accounts of a share of the Pateel's office having been sold for 7000 rupees.

The right of the Pateel to dispose of the village lands not occupied by hereditary proprietors, together with his responsibility for the government revenue, involves the proof that the government assessment was anciently Mozehwar, or by the whole village, and not by direct agreement between the government agents and individual farmers. The village, in fact, was assessed at a certain fixed sum, which was called the *Tunkha*, which means an assignment; and this Tunkha appears in village accounts to this day, although no longer a standard of assessment, as the

* Journal of the Royal Asiatic Society.

† This prince has six out of seven shares in the office ; nevertheless the poor Mahratta who has the seventh share has precedence of the prince.

British government settles directly with the farmer, and has also abrogated the right of the Pateel and the village corporation to dispose of waste lands; in alienated villages, however, these rights remain. Although the translation before noticed gives a minute detail of the rights and emoluments of the Pateels of Kuweeteh, it is to be understood they are not uniform either in number or value throughout the country. An idea of the value of the Googree, or right to a share in the grain-produce of cultivated lands, may be formed from the fact, that at Kurjut, Ahmednuggur collectorate, in 1827, there were 8491 beegahs of land under cultivation, and the Pateel was entitled to 128 seers for every 120 beegahs; he received therefore, 9057 seers of grain, a sufficiency for the annual support of 25 persons.

The duties of the Pateel were, to be responsible for the revenue of the village, to superintend its police, and regulate its internal economy. He had power to seize, imprison, and fine offenders.

With regard to joint proprietary in the office, independently of shares being held by different casts and families, the Hindoo law of inheritence, which gives equal shares of all property to all children, necessarily made many joint owners in a family; but as the executive duties are only performed by the head of the family, this person is called *Mokuddum*, "chief" or "leader;" and the term of course is applicable to the head of each proprietary family, who is designated in the village papers as half Mokuddum, quarter Mokuddum, or seventh Mokuddum, according to the share of the Pateelship held by the family.

Koolkurnee.—The next village tenure is that of Koolkurnee, from the Sanscrit *Kool* "to count," and *Kroot* "to do," "make;" literally an accountant. The office is of very great importance, for the Koolkurnee is not only the accountant of the government revenue, but he keeps the private accounts for each individual in the village, and is the general amanuensis; few of the cultivators, the Pateels frequently inclusive, being able to write or cypher for themselves. In no instance have I found the office held by any other cast than the Brahmanical. The office is sometimes united with that of Deshpandeh, and not unfrequently to that of Johesee or village astrologer. The Koolkurnee, like the Pateel, has Eenam land, sometimes salary, fees of grain, and miscellaneous rights of butter, raw sugar, &c., rarely having equal rights, either in number or value, with the Pateel, but commonly averaging from 25 to 75 per cent. below. Where the villages are very small, there is only one Koolkurnee for several villages, as in the case of Turruff Muhr Khor, Poona collectorate, where the duties of this individual extend to one small town and

eleven villages. He is here paid by a money rate for every 30 beegahs of land under cultivation; it varies from 1 rupee the 30 beegahs to 3 rupees.

Unlike the Deshmooks and Pateels, no instance came to my knowledge of shares of the office being alienated from the family; the numerous sharers being all connected by ties of blood, who each in turn take their annual duties; and these sharers are sometimes so numerous, that at one town the execution of the duties only came to the same individual after a lapse of 20 years. The executive duties should be confined to the same person.

Mahrs Tenure.—A very important tenure in villages is that of the low-cast people, called *Mahr* by the Mahrattas, and *Dher* by the Moosulmans. They have Eenam lands in all villages, divided into *Hurkee* and *Arowlah*; the former is rent free, and generally bears a small proportion to the latter, which pays a low quit rent. The Mahrs conceive that they have the right to mortgage or otherwise dispose of lands held for the performance of specific duties to the village and the government, and numerous instances of mortgage came to my knowledge; but whether they can wholly alienate their lands or not, they *cannot* absolve themselves and their descendants from their duties: these are to cut wood and grass for government officers and travellers, to act as guides, as porters to carry baggage from village to village, and to go as messengers; they have to attend strangers and see to their wants being supplied, and if the strangers be of consequence, they or the Ramooses have to look to the safety of their baggage at night. They are the guardians of all village land-marks; they are the Pateel's messengers, (something like parish beadles,) and it is their duty to carry the collections to the treasurer of the district; they have to pass on all news or information received, whether written or verbal, whether by sign or by token, to all the surrounding villages, and it is perfectly astonishing the rapidity with which intelligence is diffused by their means. It is no uncommon thing for a distant public event to be whispered about in towns before any account of it has been received by the government post. Occasionally the answer to my inquiries respecting the duties of the Mahrs was, that they were to do every thing they were ordered, whether by the Pateel, the village corporation, or by the government. There are many families of them in every village: in some villages they have to pay a tax to government called *Rabta Mahr*, and this is in lieu of personal service in cutting wood and grass for the officers of government, but it does not absolve them from their other

duties. So strictly is it their province to cut wood and grass, that their signature to all village or public documents is a sickle or hatchet to cut grass and wood, and a rope to tie them up. In addition to their Eenam lands, the Mahrs, in virtue of their office as one of the Bara Bullooteh or twelve village officers, craftsmen, and professions, receive fees in kind from all the cultivators; the fee in kind is a per centage upon the produce, but it is not uniform in amount throughout the Dukhun. These twelve village officers are divided into three classes, according to the supposed importance of their services to the village; the first class in some villages received 50, the second 20, and the third 10 or 15 bundles or sheaves of Joaree, (*Andropogon sorghum*,) stalk and grain included upon every 1000 cut down; and the same proportion of other grains. Many farmers in various parts of the country assured me that they put by 25 per cent. of their produce for the village craftsmen and professions: and as the Mahrs from their usefulness share in all those classes, their returns must be considerable: the individual benefit depending of course upon the magnitude of the body constituting this class of persons in the village. As low casts do not cultivate their Eenam lands, they derive less advantage from them than other Eenamdars, but make the best terms they can with the Koonbees to cultivate their lands for them. The Mahr does not pay any tax to government upon his Bullooteh. In the whole of the duties of the Mahrs, whether for government, the village, or individuals, they are not bound to go beyond the village next to their own: here they hand over their charge and return.*

Bara Bullooth Tenure.—The twelve craftsmen or professions which were originally in every village were, the *Sootar* (Carpenter), *Chambar* (Shoe-maker), *Lohar* (Ironsmith), and *Mahr*; these constituted the Torlee Khas or first class. In the Mudlee Khas, or second class, were the *Pureet* (Washerman), *Koombar* (Pot-maker), *Nahwee* (Barber), and *Maang* (Skinner and Rope-maker). And in the third or Dhaktee Khas, the *Kohlee* (Waterman), *Johesee* (Astrologer), *Gooruw* (cleaner of, and attendant at the temple), and the *Sonar* (Silversmith): and, since the Moosulman rule, the *Moolana* or Moosulman priest and schoolmaster has been added. These persons, in their several lines, and according to their several abilities, were to do for the cultivators individually and the village collectively whatever might be required from them; and they were paid by an an-

* In speaking of the duties of the Mahrs I ought to have used the past tense instead of the present in *some cases*, government having partly absolved them from duties, the performance of which is their tenure for holding their lands and fees.

nual per-centage in kind upon the produce of the farmer; and this was called their Bulooteh, whence the term Bara Bulooteh: the fee being called Bulooteh, and the receiver of it Bullootehdar. Very rarely could I get either farmer or Bulootehdar to state specifically what the one gave, and the other was entitled to receive; it depended very much upon the crops, and also upon the extent of services performed for each individual cultivator. These craftsmen have frequently small portions of Eenam lands, and part of their Bulooteh goes to government as a tax.

Shet Sundee Tenure.—Lands were given to a kind of militia in the districts in place of pay, for the performance of certain duties, principally in the protection of their villages: this tenure is called Shet Sundee from *Shet* "a field," and *Sunnud* "a grant;" constituting the holders, in fact, a landed militia. Although this tenure may have been general at one period, I only observed lands set apart as Shet Sundee in five Pergunnahs of the Poona collectorate, and I remarked it also at Kurmulla, Ahmednuggur collectorate.

Tenure of Chowgulla.—There are several other tenures, of which a brief notice only may be given. The Chowgulla is the Pateel's assistant; he is found in most villages; sometimes he has a trifling grant of land, but most commonly grain-fees from the landholders. This personage is called Buglah where the Kanree language is spoken.

In some Turruffs a Havildar is met with; the term is of Arabic origin, from *Hawala* "charge," "custody," and *Dar* "agent," "holder." This officer was introduced by the Moosulmans as a supervisor in the collection of the revenue of a certain number of villages. He replaced the Hindoo Naik, who is still met with in some of the hill districts. The Havildar was paid by half a seer of grain from each beegah under cultivation; and for the Hindoo officer the same is levied, under the name of Naikwaree. At Kanoor, Ahmednuggur collectorate, the Naikwaree is 12 seers of grain on every 30 beegahs under cultivation.

Tulwar.—In the southern villages bordering on the Kanree tracts, I met with the village or Turruff officer called Tulwar: but the term is unknown to the genuine Mahrattas. His duties assimilate him to the Havildar and Naik of more northern tracts.

Tenure of Ramooses.—Between the parallels of latitude 17° and 19° north, and longitude 73° 40′ and 75° E., there are few villages in Dukhun without their Ramooses. These vagabonds are thieves by birth and cast, which is abject: most of the villages have them in employ to guard the village from robbery. In some villages they have Eenam lands, but they are generally paid in fees of grain upon the cultivation.

There is a perfect community of interest amongst the fraternity, however dispersed; and as they are dissipated, idle, and reckless, they not unfrequently assemble in bands, take to the hills, and commit depredations in the country, and it is necessary to chase them back to their villages by means of the regular troops. They are expert sportsmen and good shots.

Bheels.—Where the Ramooses are wanting, their places are mostly supplied by the Bheels, or by the Kohlees; the former are low casts, the latter are Shoodrahs. Their duty is to afford protection to the villages, and they have either Eenam lands or fees in grain. In many parts of the country, particularly in Khandesh, the inhabitants of entire villages, and even districts, are Bheels, or Kohlees (Coolies).

Sheteh.—Sheteh is the person by common consent admitted to be the head and spokesman of the mercantile and trading classes, in places in the districts where they are in sufficient numbers to require one; and as combination is universal, he is of some importance in the districts as their organ in regulating prices. The *Sheteh* is assisted by the *Mahajun*, which properly means a banker; but, as the colleague of the Sheteh, he is an inferior personage in the districts: both these people, in some towns and villages, have trifling Eenam lands and claims for money and grain; but on what tenure of service to the community is not very apparent.

Sur Pateel, and Sur Deshmook, and Sur Desaee.—I should scarcely have introduced any mention of the Sur Pateel, and Sur Deshmook, and Sur Desaee, as it has not come to my notice that they hold lands in tenure, but their names frequently occur in village accounts as Hukdars,* or entitled to certain rights in money, grain-fees, &c. One of the Sur Pateelships is vested in the great family of Eshwunt Rao Dabareh, of Tullegaon; and one of the Sur Desaeeships in the ancient family called Chaskur. Captain Grant Duff, in his History of the Mahrattas, makes mention of several Sur Deshmooks, and says, that Arungzebe allowed the old Sur Deshmooks 2 per cent. on the revenue. But the Sur Deshmookee of modern times which appears in all village accounts, was 10 per cent. of the Moghul revenue, exacted by Sewajee from the Moosulmans; it was levied over and above the land tax. The sufferers, therefore, by Mahratta violence were the Mahratta cultivators; and on the whole of the possessions of the Moosulmans coming into the hands of a Mahratta government, the Sur Deshmookee should have been abandon-

* *Huk* "a right," and *dar* "a holder."

ed, but it remains to this day; for instance, at Jehoor, near Ahmednuggur, the Tunkha, or government revenue or *assignment*, from the town was 10,817 rupees, 2 qr., 3 reas; the Sur Deshmookee 1350 rupees, 3qr., 3 reas; but the Kumal, or total sum raised from the cultivators, including village expenses and Hukdars, was 19,363 rupees, 3 qr., 1 reas: so that the Moosulmans originally took little more than half of the revenue now raised from the town, that is to say, the Moosulmans took 10,817 rupees; then came Sewajee, the Mahratta, and wrenched from them 10 per cent. of their revenue, which should have been 1081 rupees. The Moosulmans, instead of paying it out of 10,817 rupees, clapped the demand of Sewajee upon the town as an additional burthen; and instead of honestly fixing it at 1081 rupees (10 per cent. of 10,817), they adroitly took occasion to exact a little more from their Mahratta subjects.

Many individuals have shares in the village revenues under the names of *Mokassa*, *Sahotra*, *Babtee*, and *Nargowra*. The most intelligible way to describe these, is to say that persons have money assignments, amounting to a definite per centage on the revenue, under these names. In their origin, Mokassa is 66 per cent., Sahotra 6 per cent., Babtee 25 per cent., and Nargowra 3 per cent. of the *Chout*, or fourth of the whole Moghul revenue, which was extorted from the Moosulmans by the Mahrattas. Sewajee and his chiefs shared it amongst themselves; the chiefs had the Mokassa for military services; the Sahotra was given to the Punt Suchew, one of Sewajee's ministers; the prince's own share was the Babtee; and the Nargowra, which is synonymous with Sur Pateel, or chief of all the Pateels, was at the disposal of the prince. As these grants were hereditary, the equal division of property and rights amongst children has occasioned the reduction of some of the shares to the most trifling amount where families have multiplied.

Such are the tenures that came under my notice; and it is necessary to state that, with the single exception of Surwa Eenam or "entire gift," there was an obligation of specific service on the individual or parties enjoying advantages under the several tenures; the non-performance of these duties involved the forfeiture of their rights; but independently of such forfeiture, all grants whatever (unless specified to the contrary) were resumable by the sovereign or other grantee. Grants for religious purposes were rarely recalled; bur for other objects they were frequently abrogated, particularly *Jagheer*, *Surinjam*, and *Hukdar* grants. To such an extent did this exist under the Peshwa's government, that the Hon. M. Elphinstone, in his report as commissioner, enumerates as an

item of revenue, *Wuttun Zubeet,* or sequestered lands of Zumundars, which yielded annually 50,000 rupees.

Revenue.

A few figures perspicuously arranged, are more efficacious in affording just impressions of the resources of a country, their ramifications, pressure, and availability, than the most laboured verbal details. In 1827-28 the assessments in the four collectorates of Dukhun amounted to 8,435,214 rupees, 3 qr. 79 reas, being a diminution of 539,399 rupees, 2 qr. 80 reas in the revenue of Fuslee 1231, A. D. 1822, as stated in Mr. Chaplin's report; from this sum also were to be deducted the remissions of 415,0[illegible]0 rupees, 1 qr. 25 reas in the Ahmednuggur, and 416,320 rupees, 3 qr. in the Poona collectorate in 1827-8, amounting to a total diminution of 1,360,725 rupees, 3 qr. 05 reas, or 15.16 *decl.* per cent. of the revenue of 1822.

The revenue of 1827-28 in its constituents is shown in the following table:—

Denomination of Revenue.	Fuslee 1237.—Revenue, A. D. 1827-28.			
	Poona Collectorate.	Nuggur Collectorate.	Dharwar Collectorate.	Khandesh Collectorate.
	rupees. qr. reas	rupees. qr. reas	rupees. qr. reas.	rupees. qr. reas.
Land revenue	1,5 6,323 .. 37	1,8 5,8 7	1,945,323 2 08	1,664,904 3 32
Sahyer*......	231,262 1 ..	59,007 3 78	334,668 .. 85	131,710 3 ..
Customs......	241,114 1 25	159,150	141,524 2 46	155,560 3 ..
Miscellaneous.	3,391	.. .. ..	.. .. ..	35,556 2 68
Total.........	1,992,000 2 62	2,033,994 3 78	2,421,516 1 39	1,987,733 .. :
Grand Total 8,435,244 rupees 3, qr. 79 reas.				

From the preceding table it will be seen that in the several collectorates, although of very disproportionate superficial extent and population, in Ahmednuggur, Poona, and Khandesh there is a close approximation in the total amount of their revenues, although with some difference in the value of their great branches.

* Sahyer is the revenue raised from shops, markets, liquors, &c. Sahyer is a "market" in Sanscrit.

The following table exhibits the proportion per cent. of the great branches of the above revenue.

Denomination of Revenue.	Proportion per cent. of the great branches of revenue.			
	Poona Collectorate.	Naggur Collectorate.	Dharwar Collectorate.	Khandesh Collectorate.
Land revenue.	per cent 76·12	per cent. 89·275	per cent. 80·365	per cent. 83·76
Sahyer	11·62	2·900	13·820	6·63
Customs......	12·10	7·825	5·815	7·82
Miscellaneous	0·16	..	..	1·79
	100.	100.	100.	100.

There is considerable uniformity in the respective proportions of the land revenue in the different collectorates. Poona has the smallest, but it is compensated for in the magnitude of the Sahyer and customs. In Ahmednuggur the proportion of the land revenue exceeds that of Poona by 13 per cent, but this is counterbalanced by the singular smallness of the Sahyer branch. In the land revenue of Dharwar and Khandesh there is a sufficient approximation to a mean per centage for the four collectorates, which averages 82·30 *decls.* per cent. The whole revenue of England being £52,000,000, has only a land revenue of £2,000,000 or 3·846 *decls.* per cent. The whole revenue of France being £40,000,000, the land revenue is 12,000,000. or 30 per cent.

The following table shows (in 1827-28) the amount of the land revenue in each collectorate, the number of cultivators, the average rent of farms, the number of British populated villages, and the average revenue of a village: the last column is intended to show the pressure (including land Sahyer and customs) of the assessments and taxes, viewed as a capitation tax.

Names of Collectorates.	Number of British populated villages.	Average revenue per village.	Land revenue.	Number of Cultivators.	Average rent of farms.	Land revenue, Sahyer, Customs, &c., viewed as a capitation tax.	
		rup. qr. rs.	rup qr. rs.		rp. qr. rs.	rp. qr. rs.	£. s. d.
Poona......	1469½	1253 1 98	1,516,323 .. 37	52,668	28 3 16	4 1 78	0 8 10¾
Nuggur	1878½	1082 2 99	1,815,837	41,948	43 1 15	3 3 77	0 7 10¼
Khandesh	2367½	839 3 7	1,664,905	44,608	37 1 33	4 1 92	0 8 11½
Dharwar. ...	2104	924 2 33	1,945,323 2 80	60,701	32 .. 19	3 1 60	0 6 9½
Total	7819½	887 3 32	6,942,388 1 77	199,925	34 2 90	4 .. 02	0 8 0

The population, inclusive of Sholapoor and Cheekoree and Munowlee, of the Company's possession in Dukhun, but exclusive of alienated villages, is 2,105,886 souls, and the gross revenue 84,435,245 rupees; equal, therefore, to 4 rupees, 0 qr. 02 reas per head.

In forming the above table, the collectors were good enough to supply the number of villages and cultivators in 1827-28, and the amount of the land revenue was obtained from the Accountant-General's office. In striking the average revenue per village, I have omitted, in the division of the Dharwar collectorate, 175 villages, (subsequently reduced to 155,) which I found by the population returns lately completed were uninhabited, but parts of whose lands were under cultivation by neighbouring villagers, and therefore included by the collector in his list. In Khandesh 330 villages have been struck out under similar circumstances. In Poona and Ahmednuggur, villages of this class are very limited in number, and I have, in consequence, not made any deduction on their account.

To give a fair average of the village revenues in the Poona collectorate, 151,241 rupees, including a share of the customs, have been deducted from the whole revenue for the city of Poona previously to striking the average. The manner in which the Poona capitation tax is struck is as follows:—1108 towns and villages sent in population returns, containing 331,615 inhabitants, averaging 226 souls and a fraction to a village. The population of the city of Poona (81,315 inhabitants) being deducted before striking the average; of these villages 212½ are alienated, leaving 895½ British villages with a population of 283,567, including Poona. These in 1827-28, yielded a gross revenue of 1,261,711, averaging 4 rupees, 1 qr. 78 reas to each person.

The capitation rate in the Ahmednuggur collectorate is obtained as follows: In 1827-28, 1877½ towns and villages were on the collector's list; they contained 494,669 souls, estimated from the average number of inhabitants to a village, namely, 263·47, struck from the census of 1822, to which the *present* population of the city of Nuggur is to be added, namely, 21,208. The revenue from the collectorate was 2,033,994 rupees, 3 qr. 78 reas; equal, therefore, to 3 rupees, 3 qr. 77 reas per head.

In Dharwar the averages have the following elements:—in 1827-28, 2279 British towns and villages produced a revenue of 2,421,516 rupees, 1 qr. 39 reas. This included the villages, revenue, and population of the Talooks of Cheekoree and Munowlee, received from the Kolapoor state; population returns were not received from these Talooks; their

revenue from 225 villages, namely, 197,406 rupees, 3 qr. 29 reas, is therefore deducted from the total revenue of the collectorate, leaving 2,224,199 rupees, 2 qr. 10 reas, and 2054 villages. From the latter are to be deducted 175 depopulated villages, but having a small part of their land cultivated by neighbouring villagers, leaving 1879* British villages, with a population, agreeably to the census, of 653,892 souls, giving 3 rupees, 1 qr. 60 reas per head.

There is some difficulty in ascertaining how the revenue of Khandesh would fall as a capitation tax, in consequence of the increased number of villages (335½) rendered productive since 1825-26, (the date of the population returns,) their population not being known. In 1825-26 the inhabited villages amounted to 2032, and 330 were Pyegusta, i. e. deserted, but having part of their land cultivated by neighbouring villagers. Supposing the new villages to be peopled in the same ratio as the old ones, the number of inhabitants in the government villages in 1827-28 would have been 443,518, which is 24,031 souls more than I have put into the population returns: and as the revenue was 1,987,733 rupees, the people averaged an individual payment of 4 rupees, 1 qr. 92 reas: nevertheless, I have reason to doubt the actual increase in population to the extent I have given Khandesh credit for; and should it have remained stationary, the revenue as a poll-tax would amount to 5 rupees, 1 qr. 40 reas per head.

With respect to the branch of revenue called Sahyer, it will be seen that the different collectorates raise it in very unequal proportions. The unusual lowness of it in the Ahmednuggur collectorate is of difficult explanation. The following table shows the number of persons of each class paying this tax, the amount paid, and the average per head.

Collectorates.	Number of taxable persons.		Amount of taxes.	Average per head.
	Sahyer.	Bullooteh.	rup. gr. rs.	rup. gr. rs.
Poona........	14,551	8481	231,262 1 00	10 .. 16
Ahmednuggur.	9,287	4980	59,007 3 78	4 .. 54
Dharwar......	29,046	[illegible]	334,668 .. 45	10 2 02
Khandesh	[illegible]	[illegible]	131,711	11 1 83

It is consequently found, that Ahmednuggur, with a greater num-

* Subsequently increased to 1899, with a population of 660,852.

ber of taxable persons in the Sahyer branch than in Khandesh, averages a payment per head of little more than one-third of what the shopkeepers, trades, and Bulloteh pay in Khandesh; and the tolerable uniformity in the individual averages of the collectorates of Poona, Dharwar, and Khandesh, proves that their Sahyer taxes are raised equitably. I have to notice, that in village papers there is a want of uniformity in the classification of the extra cesses, sometimes articles being placed under the heads of Sahyer which bear upon the land, and others again being classed with the land which are money commutations for labour.

From the definite character of the elements in the preceding table, great confidence may be placed in the correctness of deductions from it. The numbers of taxable persons in 1827-28 were supplied to me by the collectors, and the amount paid is extracted from their Jummabundy settlements for that year.

Customs.—The customs vary considerably in the different collectorates; those of Poona, being above 12 per cent. of its whole revenue, may be looked upon as high, but their magnitude manifests a favourable commercial industry. Contrary to expectation, Dharwar, which has indications of internal comparative prosperity, has the lowest revenue from customs, with a greater population, a greater revenue, and falling lighter upon the people than in any of the other collectorates, and with more than ten times the number of manufacturers* to be found in Poona and Khandesh, nevertheless shows a commercial return 52 per cent. less than that of Poona, and even 25½ per cent. below the exhausted province of Khandesh. It seems anomalous that the proportional percentage of the customs on the whole revenue in Ahmednuggur and Khandesh should be identical, the population of the former being 23.75 per cent. greater than that of the latter, while a parity seems to exist in the wants and export resources of the people of both.

Expenses.—I have put into juxtaposition some of the items of expense in the collectorates, and their rate per cent. on the gross revenue; but the want of a systematic classification of charges under common heads throughout the collectorates, renders a rigid comparison, item for item, unattainable. The information is extracted from the Jummabundy returns of the collectors for 1827-28. A government form for this paper for common adoption would render the multitudinous details involved in it more available for comparison by inspection than in the

* Thirteen thousand and forty-five weavers.

present forms. The total expenses of two of the collectorates only is given in the following tables.

Few comments are necessary, as the charges and the rate per cent. they bear upon the gross revenue of each collectorate are seen at a glance.

TABULAR VIEW OF THE EXPENSES.

Denomination of expenses.	Expenses 1827-28.											
	Poona Collectorate.			Nuggur Collectorate.			Dharwar Collectorate.			Khandesh Collectorate.		
	rup.	qr.	rs.	rup.	qr.	rs.	rup.	qr.	rs.	rup.	qr.	rs
Village & land expenses...	136.659	..	12	149,761	2	26	..	..	..	388,016	..	..
Native establishment for collections..	..	..	..	..	..	..	246,174	3	80	157,202	2	..
Mokassa......	55,997	3	43	..	..	..	..	..	..	45,358	..	..
Hukdars.	61,005	3	00	1[illegible],876	1	25	..	..	..	..	..	..
Contingent charges, including presents..	..	..	..	101,055	3	22	190,768	3	39	339,410	3	..
Shet Sundee or native militia........	34,435	2	43	..	..	..	..	..	..	..	..	..
Pensions, Eenams........	..	..	..	466,493	3	89	33,522	2	91	45,619	2	24
Collector's salary........	..	..	..	59,653	1	33	113,745	..	42	93,277	1	75
European Judicial	..	..	..	53,546	2	58	..	..	..	16,909	1	41
Native Judicial	..	..	..	229,366	2	73	..	..	..	90,306	..	..
Total	288,098	..	98	875,754	1	26	584,211	2	55	1,176,099	2	40
Remissions ..	416,320	3	..	415,005	1	25	None.			None.		
To H.H. Seendeh	..	..	..	..	..	..	..	..	..	90,796	3	33

TABULAR VIEW OF THE PROPORTION PER CENT. OF EXPENSES.

Denominations of expenses.	Proportion per cent. of the expenses on the whole revenue in the several Collectorates.			
	Poona Collectorate.	Nuggur Collectorate.	Dharwar Collectorate.	Khandesh Collectorate.
Village, land and Sahyer expenses........	per cent. 6·86	per cent. 7·36	per cent. ..	per cent. 19·52
Native establishment for collections..........	..	..	10·17	7·92
Mokassa..............	2·81	..	..	2·28
Hukdars............	3·06	5·70	..	..
Contingent charges....	..	4·96	7·87	17·08
Shet Sundee, militia...	1·73	..	..	..
Pensions, Eenams	..	8·18	1·39	2·29
Collector's salary......	..	2·93	4·69	4·67
European Judicial....	..	2·63	..	0·85
Native Judicial	..	11·27	..	4·52
Total.........	14·46	43·03	24·12	59·13
Remission............	20·89	20·40	None.	None.
Grand Total..........	35·35	63·43	24·12	59·13

For the proper understanding, however, of some omissions in the above abstracts, short notices are called for.

Under the items of "village, land and Sahyer expenses," "Shet Sundee," "Mokassa," and "Hukdars," there are blanks in the Dharwar collectorate, the whole land expenses amounting to 24·12 per cent.; it is to be presumed the charges under these heads have merged in the "Native establishment for collections." Under Khandesh there is a blank for the Hukdars; the expense of these persons is no doubt included in "village, land, and Sahyer expenses." Under Nuggur there are blanks under "Mokassa" and "Shet Sundee;" they must be included in the "Land and village expenses." Of the omissions in the Poona abstract it is unnecessary to speak, as they are intentional.

The charges, revenue, magisterial, and judicial, upon the revenue of Ahmednuggur in 1827-28, amounted to 43·03 per cent., and remissions were granted in that year to the amount of 20·40 per cent.; the total

deduction from the revenue was 63·13 per cent. In Khandesh, without any remissions, the charges were nearly six-tenths of the whole revenue. In Poona I have only shown the charges which are strictly and permanently fixed upon the land in all the collectorates, which are not mutable, and therefore scarcely susceptible in justice of modification; these amount to 14·46 per cent.: they comprise village expenses, militia, Mokassa, and Hukdars. In Dharwar, the collector's establishment has been added to the above, and it brings the charges strictly bearing on the land to 24·12 per cent. on the revenue.

A review of the above tables and abstracts suggests the following observations. The collectorate of Dharwar, having the smallest area[a] (with the exception of Poona) of the collectorates of Dukhun, has the greatest population, and produces the greatest revenue, which bears lightest by average upon the inhabitants individually.[b] Judging from the lowness of the customs, it has the weakest indications of commercial industry; nevertheless, the manufacturers, particularly the weavers, exceed those of the other collectorates in the ratio of 100 to 11, or 89 per cent. The shopkeepers and trades people are very numerous, and their individual taxes[c] rise to the average of those of Poona and Khandesh. Finally, the means of the people (remissions not being called for) must be more efficient than in the other collectorates, and a proportional ratio of imports and exports might have been looked for.

Khandesh has the largest superficial extent,[d] a population[e] 29 per cent. less than that of Poona, or granting an increase to its population 15·72 per cent. less, with a revenue nevertheless equal to that of Poona, bearing in consequence with unusual pressure upon the people, its average being 5 rupees, 1 qr. 40 reas to each soul; involving the fact that the assessments in this collectorate are greater than in any of the others. Admitting, however, the estimated increase to the population previously noticed, (which certainly exceeds the truth,) the average[f] individual payment will still exceed that in the other collectorates. It is possible this apparent pressure may be referred to the extent of its garden cultivation, which is much greater than that of Dharwar, and, as far as I can judge from observation, that

a 9122 square miles, including the cultivated area of the Talooks Cheekoree and Manowlee.

b 838,757, including the estimated population of the Talooks of Cheekoree and Manowlee, 3 rupees, 1 qr. 6 reas per head.

c 10 rupees, 2 qr. 2 reas.

d 12,527 square miles.

e 371,404, but supposed this year to be 443,548 in government villages.

f 4 rupees, 1 qr., 92 reas.

of Poona and Ahmednuggur also. In Khandesh in 1826, there were 82,697 beegahs[a] of garden-land, being 9·36 per cent. of the whole cultivated land, the garden-land in Dharwar not amounting to one-half per cent. In the Nuggur and poona collectorates, in the towns of Kurmalleh, Kurjut, Angur, and Rawgaon, the proportion of garden to field-land in cultivation was 5·45 per cent. only. But, under all circumstances, the villages of Khandesh average[b] the least revenue in Dukhun ; it stands third in the number of its cultivators,[c] but second in the amount of the rent of its farms.[d] The magnitude of this rent, it is inferred, originates in the comparative high rate of assessment per beegah, and not in the greater size of the farms. I have not the number of beegahs of land in cultivation in 1827-28 in Khandesh, but justify my inference from the following data :—In 1826 there were 37,311 cultivators, and 883,548 beegahs under cultivation, averaging 23·68 beegahs to each farm.[e] Last year, there were 44,608 cultivators, and supposing them to hold individually the average number of beegahs of 1826, the result will be as

cult.		beegahs.		cult.		beegahs.	
37,311	:	88.348	: :	44,608	:	1,056,345	;

and as the land revenue of 1827-28 was 1,664,904 rupees, the rate per beegah is therefore 1 rupee, 2 qr. 30 reas,[f] which exceedsg that of the other collectorates from 50 to 100 per cent.

In the Sahyer branch of revenue the increased pressure is still visible upon the people ; it exceeds the mean pressure of Dharwar and Poona 10·35 *decl.* per cent., and that of Ahmednuggur in the extraordinary ratio of 63·91 per cent.

The customs' per centage on the whole revenue is identical with that of Ahmednuggur, although, in the present state of Khandesh, it could not have been looked for.

Ahmednuggur stands second in superficial extent.[h] The land revenue is only inferior in amount to that of Dharwar, although it has the least number of cultivators[i] in all the collectorates. The average rent of farms therefore is the greatest ; and from averages struck in different

a 62,023 acres. b 839 rupees, 3 qr., 7 reas. c 44,608.

d 37 rupees, 1 qr., 33 reas.

e $\frac{\text{Beegahs } 883,448,}{\text{Cultivators } 37,311.} = 23{\cdot}68.$ f $\frac{\text{Rupees } 1,664,904}{\text{Beegahs } 1,056,345} = $ 1 ru. 2 qr. 30 rs. per beegah.

g Poona and Nuggur 3 qr. 58 reas per beegah, including garden-land. The whole of Dharwar 2 qr. 94 reas per beegah, including garden-land.

h 9910 square miles. i 41,948 cultivators.

villages in various parts of the Desh in this collectorate, I would refer it to the increased size of the farms rather than to enhanced assessments.

In a table, which will be met with in treating of the condition of the people, farms are made to average about 45 beegahs each; and the assessments, including extras, do not amount to a rupee per beegah.[a] In the hilly tracts the farms are necessarily much reduced in size, and an average for the whole collectorate would bring them down probably to 35 beegahs each; 41,948 cultivators therefore would occupy 1,468,180 beegahs of land, which, divided into the land revenue, (1,815,837 rupees,)[b] give 1 rupee, 95 reas per beegah. I am rather disposed to rely upon the general average, than upon the average struck from the examination of the papers of a few towns in the most favourable parts of the country.

The very low amount of the Sahyer, which is only 2·90 per cent. of the whole revenue, has been already adverted to. The taxable persons,[c] nevertheless, under this head, exceed those of Khandesh.

The customs bear a fair proportion to the whole revenue.

The average revenue[d] per village may be subject to a slight modification, as in the number of British villages, amounting to 1878½, furnished to me by the acting collector, which paid revenue last year, deserted villages are not distinguished, part of whose lands are under cultivation; and the want of population returns disables me from ascertaining them.

The revenue, viewed as a poll tax,[e] bears easier than in any other collectorate, excepting Dharwar. The means to insure an approximate accuracy in this calculation have been already explained.

Poona has the smallest land revenue, and the smallest superficial extent.[f] Previously to the addition of the four Talooks of Sholapoor, Mohol, Moodeebeehall, and Indee, agreeably to information furnished by the Survey Department, it comprised an area of 4990 square miles only. Neither the extent nor population of these Talooks being known, it was necessary to estimate them; the process was conducted by analogy, which has been explained elsewhere; 2888 square miles resulted from the calculations, giving the Poona collectorate an area of

a 2*s.* 8*d.* per acre.

b $\frac{\text{Rupees } 1,815,837}{\text{Beegahs } 1,468,180} = 1$ rp. 0 qr. 95 rs. per beegah.

c 14,267.

d 1082 rupees, 2 qr. 99 reas.

e Revenue as a poll tax, 3 rupees, 3 qr. 77 reas.

f Area 7878 square miles.

7378 square miles. Poona has the greatest number of cultivators[a] excepting Dharwar; and this is to be attributed, not to the extended cultivation, but to the Mawul, or hilly tracts, occupying a great deal of the collectorate, where the farmers are multiplied and the individual agricultural operations of very limited extent. In the whole Turruff of Mhurkhoreh the farms average only 13 beegahs each; [b] but in the eastern and south-eastern parts of the collectorate they have the same average as is given to Ahmednuggur. From the above facts the farms might be expected to average a very low rent, as is found to be the case. The following estimate justifies the inference that the land assessments are comparatively not very onerous.

In the Desh, or Table Land, the farms average.......... 45 beegahs.
In the Mawuls, or hilly tracts........................ 13 do.

2)58

Mean average of farms........ 29 beegahs.

In 1827-28 there were 52,668 cultivators, which multiplied by 29, the average number of beegahs to each farmer, will give 1,527,372 beegahs of land under cultivation; and as the land revenue of 1827-28 amounted to 1,516,323 rupees, 37 reas; the assessments would only be at the rate of 3 qr. 97 reas per beegah,[c] including garden land and extras. There are still however some marked features which are not satisfactory: the villages average a greater revenue (excluding the city of Poona) than in the other collectorates, although the average village population is less for that part of the Poona collectorate, whence population returns have been received.

The 574 villages of the sub-collectorate of Sholapoor average 1272 rupees, 1 qr. 12 reas each,[d] including customs. The magnitude of the average of the remaining villages may be attributed to the great amount of the customs;[e] but deducting a suitable proportion of the customs[f] for the inhabitants of the city of Poona,[g] and the whole of the revenue of the city, Sahyer,[h] land,[i] and Abkauree,[k] and mint[l]; villages (always excluding the four talooks of Sholapoor) still average 1241 rupees, 1 qr. 76 reas each, which is higher than in any other collectorate; and as the

a 52,668. b $9\frac{3}{4}$ acres.

c $\frac{\text{Rupees } 1,516,323}{\text{Beegahs } 1,527,372}$ = 3 qr. 97 reas per beegah.

d Revenue of sub-collectorate of Sholapoor 730,289 rupees, 1 qr. 93 reas.

e 215,361 rupees, 2 qr. $37\frac{1}{2}$ reas. f 61,756 rupees, 1 qr. 63 reas.

g 81,515 inhabitants. h 56,202 rupees, 3 qr. 50 reas.

i 27,981 rupees, $81\frac{1}{2}$ reas. k 12,000 rupees. l 3301 rupees.

villages in this part of the collectorate average a fraction more than 226 inhabitants,[a] the taxes, assessments, and customs,[b] after deducting the share for Poona, 151,241 rupees, fall upon the people with the unexampled pressure of nearly 5¼ rupees per head,[c] while the people in the city[d] average only one rupee, 3 qr. 41 reas per head, including a proportional share of the customs, and the city, Sahyer, and land-tax, &c.

For the whole collectorate of Poona, including the four talooks of Sholapoor, by a process previously explained, the assessments average 4 rupees, 1 qr. 78 reas per head, which closely approximates to that of Khandesh.

Poona has the greatest number of taxable persons[e] after Dharwar in the Sahyer branch of the revenue, and ranks second in the total amount of the sum raised, which falls with a less pressure individually than in Dharwar and Khandesh, but greater than in Ahmednuggur. The manufacturers, as contributors to the Sahyer, are very limited in number.

The proportion that the customs bear to the whole revenue is a very striking feature: they are derived principally from imports, a good part of which passes on to the eastward; much is consumed in the city of Poona, and the rest is dispersed into the districts. I have observed that imports from the coast have gradually cheapened in their retail price within the last three or four years, owing, no doubt, to the combined causes of increased importation and scarcity of money in Dukhun.

The collectorate of Dharwar, whether viewed with respect to the quantity of land under cultivation; the size of its farms;[f] the amounts of its revenue; the lightness with which it falls upon the people, considered as a poll-tax;[g] the magnitude of its Sahyer; the comparative denseness of its population; its numerous towns[h] and tolerably well-peopled villages; the facility offered for instruction in the number of its schools, and the manifestations of manufacturing industry in its numerous weavers,[i] is unquestionably the finest British province in Dukhun.

Dharwar Land Revenue.—The land revenue, in its proportion to the whole revenue, stands third in the Dukhun collectorates, being 80·336 per cent.; but this apparently inferior station is to be attributed, not to the diminished quantity of land under cultivati-

a 894½ villages with inhabitants, 202,252. b 1,110,470 rupees.

c 5 rupees. 1 qr. 96 reas,

d Inhabitants of Poona 81,315. Taxes and proportionate share of customs &c. 151,241 upees.

e 23,042. f 32·74 acres, or 43·65 beegahs. g 3 rupees, 1 qr. 60 reas.

h 119. i 13,345.

on,[a] which far exceeds that in the other collectorate, (i. e. 61·11 *decls* per cent. of the whole lands, leaving only 38·89 *decls.* per cent. of waste,) but to the lowness of its land assessments, amounting only to 2 qr. 94 reas per beegah, including all extras falling on the land. The process by which this average assessment was struck is as follows. In 1827, agreeably to the population returns, the land in occupation of a cultivator averaged 32·74 *decls.* acres, or 43·65 *decls.* beegahs; in 1828, in the Jummabundy settlement, there were 60,701 cultivators, which, multiplied by 43·65 *decls.* gives 2,649,598. 65 *decls.* beegahs of land under cultivation. These divided into the land revenue, 1,915,323 rupees, 2 qr. 8 reas, give 294 reas per beegah, a low rate, which neither the examination of village accounts, nor a similar process, will give in Poona, Ahmednuggur, nor Khandesh.[b] This light assessment, equal only to 1*s.* 11½*d.* per acre, is certainly advantageous in insuring the realization of the revenue; but when put into comparison with the rent of land in England, shows the unproductive and limited character of Indian agricultural resources.

The Sahyer branch of the revenue is highly favourable, amounting to nearly 14 per cent. of the whole, and, though so productive, falls as a tax lighter on individuals than in Khandesh. The customs, being 2 per cent. lower than in Khandesh and Ahmednuggur, is at variance with the tolerably efficient character of the general resources of the Dharwar.

From the examination of village papers I find that remissions were very rare under native governments, and the facility with which they are granted under the British government, and their magnitude, testify strongly to its paternal character. Great caution, however, is requisite in granting them, not less on account of the government than on account of the cultivator himself. If obtained with facility, and without rigid and sharp examinations, and some personal inconvenience to the applicant, (from the habitual indolence of the native character,) his ordinary industry, which always requires stimulating, would be paralyzed, applications multiplied, labour diminished, and the farmer would trust to the forbearance of government rather than to his own exertions. There is another reason for caution in the strong motives that the native agents have for urging remissions, with a view to intercept them in the transit of accounts through their hands.

The collector cannot possibly personally ascertain the truth of one-

a 2,308,064 acres in 1827.

b Ahmednuggur 1 rupee, 95 reas; Nuggur and Poona, partial average, 3 qr. 58 reas; Khandesh 1 rupee, 2 qr. 30 reas per beegah.

hundredth part of the claims set up; he must leave this labour to his servants, and it can scarcely be believed they will not avail themselves of the opportunity to turn the discretion given to them to private profit; in fact, I know such to be the case.

In an examination of the papers of the villages of Muhrkoreh, Poona collectorate, I found that many of the cultivators had paid instalments of their assessments (for 1827-28) previously to remissions being granted, which exceeded the amount they were required to pay after the deduction of the remissions; the poverty of some of the cultivators, consequently, must have been misrepresented. I ascertained also that part of the remissions of 1827-28 had been intercepted. Remissions are unavoidable in all calamitous visitations of Providence, which are not of confined or local operation, and which affect the returns of the earth; but to insure the benefit of the remissions to the cultivator, they should be made in a definite per centage on his total assessment, and the amount should be proclaimed more than once, and by different persons, in the public place of every village.

A few words in conclusion will suffice with respect to the great branches of the revenue. It is seen that 82·30 *decls.* per cent. of the whole is derived from the land: already the supply of agricultural produce exceeds the demand, and the farmer has a difficulty in finding a mart. In the present state of agriculture therefore, this branch of revenue is at its maximum, and will probably decline until supply and demand be adjusted.

The prospects of improvement in the Sahyer branch are not more favourable than in the land revenue.

The trades pay to the full extent of their means at present, and manufactures cannot increase when the European importers of cottons can afford to undersell the native manufacturers. Indeed I believe little more than coarse Sarhees[a] for women, and common tent cloth, are now manufactured in the British provinces in Dukhun.

The improvements in customs should usually depend upon increased wealth and commercial industry in the people. The extent of imports will only be commensurate with the means of purchase. If therefore the opinions I have advanced on the land revenue and Sahyer be well founded, with respect to the limited means of persons paying taxes under those heads, the customs will be influenced by causes affecting them.

a Dresses.

Any general improvement in the revenue would seem to require the creation of exportable articles in agriculture, horticulture, or manufactures; and to effect this desirable object, the introduction of persons with capital, enterprize, ingenuity, commercial tact and industry, is necessary; essentials, of which the country is at present destitute.

The manner in which the revenue yielded by a village is partitioned, is well exemplified in Neembawee, Pergunnah, Kurdeh, Ahmednuggur collectorate. The village is in Jagheer to Bala Sahib Rastia, one of the great Jagheerdars. The shares in the village are called amuls[a], and there are six of them; Rastia has three, Suchew[b] Punt one, and the Honourable Company two. The whole shares are considered as an integer of 123 parts.

Sun, 1236.—A. D. 1826.

Rastia has the Jagheer[c]	50	
Sur Deshmookee and Nuzzur[d]	23	
Kussur,[e] or remainder	7	
	——	80
Suchew Punt has the Sahotra	23	
	——	23
The Honourable Company has the Mokassa	15	
and the Neem Chowthaee, or half of the tribute called "Fourth"	5	
	——	20
		——
Total		123

In addition, the fixed money rights on the village are—

	Rupees.
Sur Pateel Dabaree of Tellegaon	5
Kundeh Kurdehkur Deshmook	101
Amrut Row Joonurkur Deshpandeh	101

Besides the Pateel and Koolkurnee, Chowgulla, Bullooteh, who have their fees.

It would seem very desirable to abolish the above absurd verbal dis-

a Amul, "rule," "sway."

b Suchew, "friend," "minister;" one of the eight ministers of the Rajah of Sattara.

c A fief.

d Nazar, "sight," "look," a present made on introduction to a person.

e Kasr, "a fraction."

tinctions, and to fix the rights of individuals as simple money dues, without reference to Jagheer, Nuzzur, Kussur, &c.

The revenue of Dukhun, contrasted as a capitation tax, with that of England, France, and America, would appear to be as follows. In England, the gross revenue of 1828 was £50,700,000; poor-rates, parish rates, lighting, watching, £12,000,000; contributions of congregations to their clergy, colleges, schools, &c. about £17,300,000: total £80,000.000.[a] The population being 20,000,000, the tax per head is £4. In France, the taxation, including provision for the clergy, schools, &c. is £40,000,000; the population 30,000,000; equal therefore to £1. 6*s*. per head. In America the population is between 10,000,000 and 11.000,000, and the taxation £5,000,000, or not quite 10*s*. per head. The revenue of Dukhun, viewed as a capitation tax, is 8*s*. per head.

Assessments.

Assessments and land measurements are so intimately connected, that it would not answer any good purpose to treat of them in separate sections. With respect to the portions of land variously denominated for the purpose of assessment, I am clearly of opinion that the prevailing denominations amongst the Hindoos were not descriptive of superficial extent, and that the assessments were founded on the productive power of the land without reference to its quantity, and were uniform only for similar denominations of land in a village.

The Moosulmans, no doubt, endeavoured to be more systematic; they measured garden lands, and probably in some few villages, the field lands, under the denominations of Kundhee, Mun, Tukeh, Piceh, Seer, &c. with a view to the general conversion of such terms into the uniform and appreciable term of Beegah; but the Hindoo terms not applying to quantity, the beegahs of different villages could only be equal when there existed an accidental identity in productive power in the *unmeasured* Mun or Kundhee, &c. of land in one village with the *measured* Mun, Kundhee, &c. intended as common types. This will account for the varying extent of the beegah in field cultivation in Dukhun. How little successful the Moosulmans were in their attempt to supersede the old terms, is proved in the limited extent to which the assessments by beegahs obtained when we took possession of the country. It may be well doubted whether we shall be more successful in our introducti-

a Speech of Colonel Davies in the House of Commons, May 8, 1829.

on of acres : the ramifications of ancient usages amongst a people are in general too deeply fixed to be eradicated by legislative enactments. A plant may be cut off by the surface, but there is always a latent disposition to reproduction from the untouched roots. Whatever may be our success, a revenue survey was imperatively called for under the indefinite Hindoo land denominations, to enable a collector to regulate his assessments with a shadow of equity.

With respect to the denominations under which land is assessed in the comparatively limited space of my inquiries, their variety and absurdity demonstrate a wanton *bizarreness* that could scarcely have been looked for in a people reputedly simple and uniform in their opinions and economy. The assessment on a beegah is definite as it depended on positive measurement, and I have remarked that it obtains at, and in the neighbourhood of the established seats of Moosulman authority, as at Ahmednuggur, Purunda, Sholapoor, Mohol, Barlonee, Wamoree, Tacklee, &c. The Chahoor and Rookeh, as at Alkootee, Kheir, Wangee, Taimbournee, Kurkumb, Angur, Mahreh, Kurmalleh, Kurjut and Meerujgaon, being multiples of the beegah, are intelligible. Even the Doree or rope, used at Hungawarreh and Neembee, as it implies measurement and superficial extent, is admissible. The old Hindoo terms, Kundhee and Mun, at Ranjungaon, Jamgaon, Parnair, &c. &c. as they are founded on positive properties, furnish sufficiently precise ideas. But the Tukeh, with its constituents of Sujgunnees and Piceh, (copper coin,) at Dytna and Ankolner, the seer of weight and its Nowtanks or $\frac{1}{8}$ Seer, as at Koorul and Wangee, and the Pyhnee and its Annas[a] at Serrolee, Bruhmunwarreh and Muhr, are not reducible by any operation of the mind to an appreciable portion of land, whose produce shall admit of the government share on it being equitably assessed. The assessment by the hatchet, rude as it is, still involves the idea of as much copse-wood land as one hatchet can clear, and one man can sow and reap in the year. To add to the confusion, similar denominations of land are not made up of common and uniform constituents. The Tukkeh at Kothoul is raised from the Rookeh, each of which is supposed to contain 10 beegahs, or $7\frac{1}{2}$ acres. At Ankolner the Tukkeh is composed of Sujgunnees, Piceh and Rookeh; the Rookeh being equal only to $2\frac{1}{2}$ beegahs, or $1\frac{7}{8}$ acres. At Lakungaon there are 10 Tukkeh to one Pyhnee, and as the Pyhnee is said to contain 30 beegahs, the Tukkeh here contains only 3 beegahs instead of 480, as at Tellegaon ; or 210, as at Ashtee.

a One-sixteenth of a rupee.

In respect to the Mun at Ranjungaon, it is rated at 10 beegahs; at Jamgaon, belonging to Seendeh, it is not reducible into beegahs at all; at Parnair 6¾ beegahs only are equal to the Mun. The Pyhnee at Seerolee has the Chahoor of 120 beegahs as a typical standard, 4 Pyhnees being equal to one Chahoor, or 120 beegahs; at Muhr the Pyhnee of 30 beegahs is considered as identical with the Kundhee of 20 Muns, reducing the Mun therefore to 1½ beegahs.

Under such complex definitions and involved contradictions, my limits will not permit me to give further explanations, but which my lengthened tables afford.

The principal assessment necessarily falls on the land, and it is raised on the various land denominations above noticed; the land in the first instance being separated into the two great classes of Bhaghaeet, or garden-land; and Zerhaeet, or field-land. Both these terms are evidently of Moosulman introduction, Bhaghaeet being a word of Persian origin, meaning "gardens," "orchards;" and Zerhaeet, of Arabic derivation, meaning a "sown field," "sown land."

There are marked traces of the land assessment having once been systematic in the Sostee or permanent rate, which was uniform and unchangeable for all lands of the same denomination. This rate is found in most villages, it is distinctly stated in the accounts, and separated from subsequent and increased assessments, and its existence is a proof that assessments formerly were not on the superficial extent, but on the productive power of the soil; since, as lands were not all equally fertile, more of the unfertile land must have been held than of the fertile, to enable the cultivator to pay a fixed sum in quantity of grain for a piece of land under a common denomination. The *Sostee Dur*, or permanent assessment, was the pride of the Meerasdar, but unhappily not his safeguard. The various governments which have passed away do not appear ever to have *raised the permanent rate*, but they rendered the advantages derivable under it abortive from gradually adding extra cesses; their excuses in the first instance being unlooked-for contingencies. The cesses were originally mostly in kind, and temporary; but the exigencies of government, or the facility with which they were raised, made them perennial, and their pressure upon the cultivator has been enhanced, particularly under our government, by the cesses in kind being commuted into money payments. The Moosulmans, on introducing measurements, must necessarily have subverted the Sostee, or uniform rate, since the same rate could not have been equitable for beegahs of land of different qualities. We find, in consequence, that when the lands are classed in beegahs

otherwise than as constituents of Hindoo land denominations, that there the assessments are on the quality of the soil, and vary accordingly.

Gardens being dependent on the local advantages of a suitable supply of water and some depth of soil, usually met with in hollows or on the banks of rivers, it might be expected that considerable uniformity would prevail in the quality of garden-land, and that it would rarely be divided into classes; such is usually found to be the case. Most commonly all garden-land appertaining to a village pays the same rate per beegah; and where classification exists, it is founded, not on the quality of the land, but on the extent of the supply of water.

The first great feature, in this respect, is whether the garden is watered from small streams conducted from rivulets or rivers, or whether it is watered from wells; in the former case it is called Paatsthul,[a] and in the latter Mohtsthul.[b] Most Pahts failing in the dry months of March, April, and May, the former land is usually assessed at a lower rate than the latter, as at Tellegaon and Parnair; but where the Paht supply is perennial, as at Dytna, both descriptions of land pay the same rate. Dependent on these primary distinctions, are modifications, affecting garden assessments: land with a perennial and sufficient supply of water, whether from pahts or wells, is called Wohol-Waho, or fully watered, and pays the highest rate; this rate, unless on rice land, and isolated spots, where fruits of considerable value are raised, such as grapes and golden plantains, &c., as at Joonur, within my observation, has never exceeded 6 rupees per beegah,[c] including sugar-cane land. The other classes of land are comprised in the Kord Waho or not fully watered. It is readily intelligible that a well may supply a sufficiency of water for great part of a garden within a reasonable distance of the well, but that the extremities may be inadequately watered, and this affords just grounds to demand a lighter tax for the extremities: two classes should result from such circumstances, i. e. fully watered and not fully watered, and such is generally the case where distinctions are made at all: but at Ahmednuggur there is an affectation of discrimination, which has determined that garden-land receives its watering in the proportions of "fully," "thirteen-twentieths," "three-fifths," and "one-half," and such lands are respectively assessed at 5 rupees, 3¼ rupees, 3 rupees, and 2½ rupees per beegah. The assessment on garden-land at present is unequal, and the whole requires revision. There is every motive to make garden-cultivation assessments light with a view to insure to each cultivator,

a From Paat "a channel," and Sthul "a field."

b From Moht "a water-bucket," and Sthul a "field."

c 16*s.* 8*d.* per acre.

if possible, his well and little plot of garden ground. Gardens produce all the year round; they are comparatively unaffected by the droughts which destroy field crops; and independently of the constantly saleable garden stuffs, fruits, and aromatic seeds, there is usually room for a beegah or more of bukshee or johr wheats, which require watering, and a plot or two of sugar-cane. To his garden the cultivator is indebted for many of the little enjoyments his situation is susceptible of. In some instances, in the Mahloongeh Turruff, Poona collectorate, I found cultivators paying their entire assessments, and reaping profit by their garden produce of chillies[a] alone, which were sent into the Konkun.

Usually it has been deemed sufficient to arrange Zerhaeet or field-land into four classes, as at Jehoor, namely, Awul (best), usually black land, Rehsee (modified black), Burrud (dashed with lime and some decomposing greenstone), and finally, Khurrud (stony, thin, and poor). The first, throughout the country, does not average more than 1 rupee the beegah, the second $\frac{3}{4}$, the third $\frac{10}{16}$, and the last $\frac{9}{16}$ of a rupee per beegah; but at other places there are other distinctions. In the Mawuls, or hilly tracts along the Ghauts, lands are classed as Bhat, Khatan, and Wurkus, the first being rice land, the second wheat and grain land, and the third being on the slopes of hills, producing the dry grains Sawa[b] and Wuree;[c] there being a great deal of red soil also in these tracts, it is distinguished by the term Tambut or copper-coloured. The Awul, or best, where it occurs, is called Kalwut (black), and the rocky and stony Maal.

These explanations are sufficient to show that where assessments on the quality of the land have been introduced, uniformity has not obtained in distinguishing the qualities; they show also that the people were satisfied to limit the qualities to four gradations; but at Ahmednuggur, the Shaikdar or inspector of cultivation has had the microscopic ability of vision to mark twelve shades of difference in the field-land. The accounts are, in consequence, a mass of perplexity, and it is very probable the revenue is frittered away in distinctions which the cultivator never dreamt of, and never profits by.

Field-lands, on which the cultivators sink wells, are not assessed as garden-lands. At Kanoor, Nuggur collectorate, I found lands so circumstanced had been free from any extra assessments from a period beyond the memory of man.

a Capsicum annuum, and other species.

b Panicum frumentaceum. c Panicum miliare.

The above notices are sufficient to show the anomalous character of the money assessments strictly on the land. Not only are they arbitrarily fixed on the productive power of the land, or on measurements, real or supposed; but lands of the same denomination and quality are differently assessed in neighbouring villages without apparent cause.

The average of all the rates at many towns and villages in all parts of the country, derived from personal inspection of the village accounts, gives 3 rupees, 41 reas for a beegah of garden-land, or 8*s.* 3⅓*d.* for an English statute acre. The average of field-land is 3 qr. 93¾ reas per beegah, or 2*s.* 7½*d.* per English acre.

To determine an approximate average assessment per beegah in Khandesh, I may use elements, which although not just, may be expected to give results not very far from the truth; namely, the total number of beegahs of land under cultivation in the population returns in 1826, and the land revenue in 1827-28: the former is 883,548 beegahs, and the revenue 1,664,904 rupees: the average rate per beegah is 1 rupee, 3 qr. 54 reas, a much higher rate than exists in the other collectorates.

These assessments comparatively with those of all European countries, of most Asiatic countries, and relatively to the valuable nature of the garden produce, comprising, independently of the ordinary fruits and vegetables, grapes, oranges, sugar-cane, cotton, two kinds of fine wheat, and aromatic and pungent seeds,—the field produce also embracing all the bread grains, gram, and other pulses,—are unquestionably very low; and were there no extra cesses even in the present depreciated value of agricultural produce, could not only be borne by the cultivator, but he might flourish under them even with the burthen of 25 per cent. on his produce—fees paid to the Hukdars and Bullootehdars. These rates, however, are considerably enhanced by extra cesses called Puttees, many of which were levied for contingencies and particular exigencies, or resulted from the conversion of voluntary offerings in kind into compulsory money payments.

These cesses are no less than 62 in number in the three collectorates of Poona, Ahmednuggur, and Khandesh, and the whole of them are for different objects; many of them result from local circumstances, and are therefore of a local bearing. The majority of these Puttees are not of uniform operation in the three collectorates, but one or more of them up to a score may be found in every village.

A few observations on the origin, character, and practical effects of some of these Puttees may be necessary. Most of them profess to bear directly on the land, such as those for grain, forage, and ropes to govern-

ment, grain to Ramooses, Havildar, Gosawees, and Meeras tax, tax for sugar, &c.: other taxes which originally fell upon trades people, such as those for skins, shoes, wool, blankets, and oil, are no longer derived from their legitimate sources, but fall upon the cultivator. Milch cattle, fowls, mango trees, and pumpkin beds respectively continue to supply the means to pay the taxes for Ghee, thickened sour milk, fowls, and fruits. Some of the Puttees involved personal labour, such as those for grass cut and furnished gratis to government, for firewood, for dinner plates composed of leaves sewn together, for monsoon great coats made of wicker work and leaves, and for sticks to pound rice with. The Rabta Mahr, spoken of under "tenures," is in lieu of personal services. Some of them in their name indicate their professedly temporary character, such as the Eksalee, or for one year, and yet they have been perpetuated. The Shadee or marriage cess at Angur, Pergunnah Mohol, and Ashtee Pergunnah Oondurgaon, amounted to nearly 12 per cent. of the whole revenue of the towns, and could only have been for a passing event. The Wurgut at Wangee and Ashtee, which was raised by the village authorities for village expenses, is one of these unjustifiable taxes. At Ashtee, the scene of the battle of Ashtee and capture of the Sattarah princes, in 1818, the Wurgut was 1405 rupees, in a revenue of 6366 rupees, or 22 per cent.; of this sum government took 900 rupees, leaving 505 rupees to the villagers for their expenses. This Puttee at the town of Kurjut, Pergunnah Kurreh Wullet, is 6 annas per rupee, or $37\frac{1}{2}$ per cent. on the land and Sahyer assessments, and Burgoojur or tax on betel gardens. At Rawgaon, the Wurgut amounted to $14\frac{1}{2}$ annas per rupee on the land assessments and taxes, or more than 90 per cent. The Kaateh Mornawul, or pecuniary punishment, inflicted on a village for a Mamlehdar's running thorns into his feet on perambulating its lands, should have had some limits in its duration. The Puttees for sturdy Gosawees, Havildars, Ramooses, Naikwarees, should have ceased when there were no longer Gosawees to beg with arms in their hands, or Havildars, Naiks, and Ramooses to exercise respectively certain functions.

The fractional apportioning the above taxes to the cultivators, involving also the compound operation of providing reduced shares for the privileged classes, the fractional deductions, in a certain ratio in case of remissions, the fluctuating amount of the individual shares dependent on the fixed commutation cesses, being yearly divisible amongst a variable number of cultivators, the mutable character of the Seerusteh Butta, which necessarily changes with the yearly varying total assessments of the village, and which Seerusteh Butta is not determinable until all other assessments be fixed, combine great

evils, and, unless to the most practised, patient, and persevering investigator, present an inextricable mass of confusion. The evils are, that a cultivator, be he lettered or not, cannot by possibility know what he will have to pay the ensuing or even the present year, because fixed sums, payable by the village, are divisible amongst a varying number of cultivators. Even if fixed sums were divisible amongst a fixed number of cultivators, the limited progress in arithmetic of the poor people would utterly disable them from determining their respective fractional shares; for instance, of 4 rupees for skins and shoes, 1 rupee for beit,[a] $4\frac{3}{4}$ for ghee, and $1\frac{5}{16}$ for leaf plates, &c. &c. In the whole course of my personal inquiries amongst this class for more than six years, I never met with one Koonbee who could or would give me a detail of his assessments or their amount; the constant reply was, "The Koolkurnee knows." This very uncertainty of their means and liabilities makes men improvident and careless.

The next evil is, that the Koolkurnee, in apportioning the fixed sums, and the Seerusteh Butta, the commutation money for grain, for ghee, sugar, pumpkins, &c. &c. is assured of impunity in defrauding the cultivators, from their want of ability in their accounts, even if they were aware of the value and amount of the cesses and the number of persons they were to bear upon. It is almost waste of labour to give the cultivator a note from government of what he will have to pay, as in nine instances out of ten he cannot read it; his expounder is the Koolkurnee, or the Koolkurnee's relations, and they read it agreeably to their own calculations.

The above is an exposition of the assessments as they now bear on the land, which produces 82·30 per cent. of the whole revenue. The remaining portions of the revenue, which appear in village papers are usually classed under the term Sahyer, and are in fact taxes. The two principal heads of Sahyer are Mohturfa, properly "Arhan," or taxes on shops, houses, and professions; and Bullooteh.

Operation of Sahyer Taxes.—An idea of the operation of these taxes will be formed by the following details from Wangee, Pergunnah Wangee.

Wanees, or sellers of grain and groceries, from 4 to 6 rupees a shop; oilman, for one oil-mill in work................ 6 rupees.
Weavers, per loom.. 3 do.

Other tradesmen pay proportional taxes. The threshold tax is called

a Beit, "a present."

Oombraputtee, from Oombra, threshold: it is generally a rupee per house.

At Tellegaon, Pergunnah Paubul, Poona collectorate, the taxes on trades are fixed on a scale of annas relatively to the visible means and profits of the tradespeople. The anna is considered equivalent to 3½ rupees. The trades are taxed from ¼th anna to 2 annas, or 7 rupees, which is the highest sum for one shop.

The highest tax on one weaver is half an anna, or 1¾ rupee; oilman, highest rate one anna, or 3½ rupees; the saddler, dyer, and butcher, at half an anna each, or 1¾ rupee: fishermen, dealers in sweet potatoes, and makers of bridles, 1 rupee each; the *community* of braziers, 10 rupees. All the Momeens who are Moosulmans and weavers of turbands taxed in the lump at 25 rupees; shepherds at 14 rupees. These taxes are not raised on any systematic principles of application.

Bullooteh Tax.—The Bullooteh is a tax levied on the persons called the Bara Bullooteh, or artizans and functionaries twelve in number, who are important personages in the village constitution.

The taxes on the Bullooteh are generally deemed to be on the exercise of their profession; but this is a mistake, as the astrologer and Guruw, or sweeper of the village temple, pay Bullooteh tax, although not artizans; and I have known individuals of a trade (in one instance a boy the survivor of a family) paying from 20 to 25 rupees per annum, which they could not possibly do from the gain of their handicrafts.

The fact is, the Bara Bullooteeh have annual grain fees from the cultivators; and government, in former times, deeming these fees more than commensurate with the value of the labours performed, took a part of them in money. The taxes on the Bullootehdar, are therefore indirectly derived from the land; some of these taxes fall very heavily. At Wangee three carpenters pay 36 rupees Bullooteh tax, Wurgut 9 rupees, and house tax 3 rupees for three houses. At Tellegaon, Turruff, Paubul, the Bullooteh taxes are yet higher: carpenter 50 rupees, shoe-makers 60 rupees, Guruw or sweeper of the temple 30 rupees, barber 24 rupees, washermen 8 rupees, Moolana, or Moosulman priest, who also gets Bullooteh, 8 rupees; but the cultivators are numerous, and the lands of Tellegaon under cultivation extensive. The Bullootehdar on the whole therefore reaps a rich harvest, in spite of government participating in his fees, from the cultivators. It is unnecessary to multiply instances of the bearing of the Sahyer taxes. Taxes for the sale of spirituous liquors, and the amount of customs or transit duties, rarely appear in village papers, as those branches of the revenue are mostly farmed.

My limits do not permit me to give a detailed statement of the manner in which village accounts are kept under a native government. It would much assist to illustrate the internal œconomy of a village and many local usages, but I have not space. I can only say that the whole accounts of a village are kept on a ribbon of paper, about five inches wide and some yards long, not rolled up but folded in lengths of twelve inches or more: one of these is required for each year. At Wangee it is called *Gao Jarah*, or village search; at Kurmulla *Jhartee Akaar*, or figures or signs of search; at Barlonee it has the compound term of *Lownee Putruck*, (detail of cultivation,) and *Zumeen Jarha*, (land search); at Rawgaon it is called *Wussool Jarha*, or search of collections: occasionally it is *Akaarbund*, or roll of signs, items, figures. These varying names result from the union of two papers which are usually kept separate: namely the *Thul Jarha*, or roll of lands by family estates; and the *Lownee Putruck*, or roll of cultivation and assessments.

In closing the notice of assessments, a few words are necessary to explain the method of keeping village accounts. At the head of the paper called *Gao Jarha* is the name of the village, the Pergunnah and Soobeh it is in, the year and the name of the government it is under; this is followed by the Tunkha or Moghul money assignment upon the village, the Moosulmans having fixed each village to pay a definite sum, leaving the whole details of assessment and distribution to the Pateel and villagers; then follows the total quantity of land belonging to the village: deductions are made for land in boundary disputes, for Eenams of all kinds, whether to the temples, to the village officers, to the Deshmook or Deshpandeh, or to individuals, the quantity to each being carefully marked; all these being deducted, the remainder is distinguished into garden and field-land; then follows a roll of the cultivators, with a number of columns to record the quantity of land held upon each tenure, and the amount payable for each; a column for the share of the extra assessments, previously noticed, including the share of village expenses, which is always considerable; also columns for totals of the different heads. Then follow rolls of the Bullooteh, shopkeepers, trades, and others subject to fixed taxes, with columns for the proportion of tax upon the particular trade; the Bullooteh, the house-tax, and share of extra assessments, which these people pay although they are not landholders.

An abstract of the preceding details is now made, called the *Ekunder Tereej*. The contract for the transit duties, if not farmed, is added; and the *Kumall*, which means "total," "all," "whole," is put at the bottom. Then follow the deductions under the heads of money—Eenams, Hukdars, village, and other expenses, every item of which is detailed.

Amongst the expenses are village festivals, dinners to government officers, donations to brahmans, feeding pilgrims, interest on money borrowed, expenses of the Pateel and village officers when attending the governor of the district, oil in the temples, the Moosulman saint's tomb (if there be one) coming in for its share of donation or annual allowance, strange as it may appear, from Hindoo cultivators. I regret much that my limits do not permit me to detail the expenses, many of which are very curious, and illustrate habits and customs. The expenses being deducted from the collections, a balance is struck, which, under native governments, *left* the Tunkha, or government original assignment, together with any extra assessment, if levied, such as Sur Deshmookee, Chouth, &c. &c. To show how large a proportion of the village collections did not go to government, in one village, whose accounts I translated, the Tunkha, or government share, was 5500 rupees: and the Kumall, or total collections, 8522 rupees; so that 3022 rupees, or more than 35 per cent. of the whole, went in village expenses, Hukdars, (Deshmooks and Deshpandehs,) and other claims.

Wages.

The amount of wages of agricultural labourers is of so much importance to the class constituting the major part of the community, and it assists the judgment so materially in estimating the condition of the people, that I shall offer all the details I was able to collect in the Dukhun bearing on the question.

Farmers' Artificers' Work executed for Fees in Kind.—The trifling artificers' and mechanics' work required by the farmer being performed by the village artisans, in virtue of their offices and for fees in kind, it will not be necessary to enlarge on the remuneration for their labour: but to afford distinct ideas of its value, at the end of this paper I shall put into juxtaposition the rates paid by the Peshwah's government and the British government to artificers, mechanics, and others.

I made my inquiries on the subject of wages in towns and villages, the most distant from each other, to prevent the mistake of the adoption of local rates for those of general operation.

Wages of Husbandmen and other Labourers at Nandoor.—At Nandoor, a British town in the Ahmednuggur collectorate, in March, 1827, I found that yearly husbandry servants got from 12 to 20 rupees[a] per annum and their food; a smart active man got about 15 rupees per annum and supplied himself with clothes.

a From 24 to 40 shillings.

Day labourers, when paid in cash, get $1\frac{1}{2}$ anna per day, or $\frac{3}{32}$ of two shillings, (about two pence farthing,) supplying themselves with every thing : but day labourers are never paid in money unles when grain is very dear.

Quantity given.—The most usual plan in harvesting crops is to give each labourer three sheaves of whatever grain he is cutting down ; and provided he ties up the sheaves and stacks them, he gets five sheaves a day.

Value of Wages in Kind, converted into Money.—The grain in five sheaves, in ordinary seasons, amounts to about two seers. At the price of Bajree*, in March 1827, at Nandoor, namely 42 seers per rupee, the value of the labour was one penny and $\frac{14}{100}$ths per day. Joaree†, at 56 seers per rupee, was $\frac{85}{100}$ths of a penny per day, or rather more than three farthings. Wheat, at 18 seers per rupee, would have been two pence $\frac{66}{100}$, or something less than two pence three farthings per day. Allowing the grain in five bundles to be double the quantity stated, which is rather possible than probable, the highest wages in harvesting wheat would not have been five pence halfpenny per diem. When men are employed in ploughing or harrowing, nine times out of ten, they are paid two seers of Bajree for their day's work, from daylight to night, allowing one hour for dinner.

At Kanoor.—At Kanoor, a town in Jagheer, Ahmednuggur collectorate, in March 1827, I found that the two Pateels had each a permanent domestic servant in his employ ; one paid his man 15 rupees per annum and his food ; the other gave 15 rupees per annum, food, and five articles of wearing apparel, the value of which was $3\frac{1}{2}$ rupees.

Wages at Dywuree.—At Dywuree, Nuggur collectorate, in November 1826, the cultivators did not pay their day-labourers in money, but gave them five sheaves of grain for every hundred cut down ; a very able man indeed might cut down two hundred sheaves in a day, which would give him four seers of grain, the value of which (Bajree) in November, 1826, was about $\frac{2}{16}$ths of a rupee, or three pence English.

Wages at Dytna.—At Dytna, Nuggur collectorate, in February 1827, I found a man getting 25 rupees per annum, his food and a blanket, his son being also in employ at six rupees a year, food and clothes ; but this was looked upon as high, and the individuals getting such wages fortunate : the village belonged to a Gosawee ‡ who paid his people well.

Wages of Women Day Labourers.—At Chambergoondeh, a large town belonging to Seendeh, Nuggur collectorate, in November 1827, women

* Properly, Sujgooreh, *Panicum spicatum.*

† Properly, Jondleh, *Andropogon Sorghum.*

‡ Gosawee, *a religieux.*

weeding in fields got $\frac{1}{16}$th of a rupee per day, or one penny halfpenny, and worked from sunrise to sunset.

Wages at Kurkumb.—At Kurkumb, a Jagheer town in the Poona collectorate, in December 1827, I found a husbandry servant getting only twelve rupees per annum, and food twice a day: no clothes. A man watching a field of grain was a monthly servant at three rupees a month, without food or clothes.

Highest Wages at Kurkumb.—From the authorities of the town I learned that the highest rate paid for the cleverest gardener's assistant or ploughman was 25 rupees per annum and daily food, but without clothes. The monthly rates for agricultural servants were from 2¾ to 3 rupees, without food, or clothes, fee, or advantage.

Pay of Seyp ys at Angur.—At Angur, a British town in the Poona collectorate, on the 9th of January, 1828, in looking over the village accounts, I found two village seypoys charged respectively three rupees and two rupees for a month's pay.

Wages of Women Labourers at Poona.—On the 21st July, 1827, I found a great number of women weeding in gardens in the neighbourhood of the city of Poona; they received each six pice in money, or $\frac{6}{64}$ths of two shillings, (two pence one-third per day,) and worked from daylight until dark. This may be considered high wages, and its amount is to be attributed to the paucity of field labourers in a great city.

Wages at Pait.—At Pait, a Jagheer town in Pergunnah Kheir, in the Poona collectorate, on the 16th February, 1829, in my evening excursion, I overtook twelve or fourteen men and women with bundles of wheat in the straw on their heads; on inquiry I found they had been employed as labourers in *pulling up* a field of wheat at Pait. Their wages had been five sheaves for every hundred gathered; two or three of the men only had got five sheaves each, the majority of them only four, and the women none more than three. Five sheaves they said would yield about four seers of wheat, and as wheat was selling in Pait at 28 seers per rupee, each man with five sheaves received for his labour nine pice, or 3½*d*. English. These poor people belonged to the town of Owsuree, five miles distant from Pait; they had therefore a march of ten miles to make besides their day's labour.

Wages at Joonur.—At the city of Joonur, at the end of February 1829, I found a brahman cultivating the Hubbus Baugh (about 80 beegahs of land); he employed numerous labourers. While I was encamped near his garden, fields of wheat, and gram, and Booee Moong*, &c. were harvest-

* Earth-nut, *Arachis hypogea.*

ed. For the wheat and gram and bread-grains the men got five sheaves per cent. In the field of Booee Moong there were between fifty and sixty women employed; and I learned that, in this particular product, from the labour and tediousness of digging it up, and the cheapness of the produce, the labourers were allowed one-fourth of the whole. In cutting down sugar-cane, gathering fruits or vegetables, and indeed where the produce was too valuable to give the labourer a share of it, the Brahman paid a man eight pice a day (little more than 2½*d.*) and a woman four, and they worked from daylight until dark, with an allowance of one hour for dinner.

The above data are gathered from places widely separated in the Poona and Ahmednuggur collectorates; and although in different years, are remarkable in their uniformity; they supply therefore just estimates for the general rates of wages, and it may be fairly stated that the highest money wages paid by the natives to any husbandry or domestic servant is four rupees per month, with which he finds his own food and clothes, and $2\frac{1}{12}$ rupees per month is the pay when the master supplies food and clothes; and the most favourable wages to a man day-labourer are eight pice per diem*, and to a woman five pice†.

Artificers' and servants' wages, and price of Bread-grains under the Peshwa's and British Governments.

Rates of hire for a month of thirty days of artificers, servants, and labourers in Dukhun, under the British government in 1828, and Peshwa's government in A. D. 1814.			Prices of grains, pulses, and other articles, the ordinary consumption of artificers, servants, labourers, &c. at Poona in Dukhun, under the Peshwa's government, being a mean of five years from 1811 to 1815, and under the British in 1828.		
Denomination of artificers, servants, &c.	Monthly Pay. Under the British.	Monthly Pay. Under the Peshwa	Grains, pulses, and other articles	Seers per Rupee. Under the British, 1828.	Seers per Rupee. Under the Peshwa, 1814.
	Rupees.	Rupees.		Seers.	Seers.
Maistry, or head carpenter	25, 35, 40	15	Rice, Putnee	16	12
			Do. Ambemor ..	13	9½
Second or under do.	23 & 25	12	Do. Rajawul....	14	12
Maistry, or head carpenter, finest worker........	30, 35, & 45	15, 20, 40	Wheat, Buckshee	18	$14\frac{1}{2}\frac{4}{2}$
			Do. Potee	20	..
			Joaree (*Andropogon Sorghum*) :	32	21⅓

* About 2¾d.

† About 1¾*d.*

Table continued.

Denomination of artificers, servants, &c.	Monthly Pay. Under the British.	Monthly Pay. Under the Peshwa.	Grains, pulses, and other articles.	Seers per Rupee. Under the British, 1828.	Seers per Rupee. Under the Peshwa, 1814.
	Rupees.	Rupees.		Srs	Seers.
Carpenter, common worker ..	15 & 22½	12	Bajree (*Panicum spicatum*)	28	$17\frac{62}{200}$
Two Sawyers	15 & 22	8	Dhall (*Cytisus cajan*)........	16	$11\frac{86}{100}$
Maistry, or head smith....	25 & 30	20	Ghee (clarified butter)	2	1½ to 1¾
Smith	15 & 22½	12			
Head armourer....	30	20			
Armourer	15	12			
Fileman....... ..	15	12			
Hammerman	6, 8, & 13½	7½			
Maistry, or head leather worker	15	12			
Leather worker, harness maker	9¾	9			
Puckalee, or waterman	15	9			
Bricklayer	9¾, 12	10			
Head bricklayer, maistry	25 & 35	15 & 20			
Maistry, or head tailor, fine worker	15	14			
Tailor	9¾	6			
Man labourer	5 & 7	5			
Woman do.	3¾ to 7	3 to 4			
Boy do.	3¾	3			
Muccadum, or chief of Dooly bearers.	15 & 20	8			
Dooly bearers	7 to 9	6			
Horse keepers	8	5	Served two horses	under Peshwa.	
Camel men	7 to 9	5	Served two camels	Do.	
Tattoo, or pack pony per month, with driver	12	15			
Camel with driver.	30	30			
Puturwut stonemason	..	12			
Bhooee Hamalls..	7, 8, & 9	6, 7, & 8			
Muccadum, or chief of Hamalls	15	10			

The above table shows a marked enhancement in the wages of all classes of handicrafts and servants, although grain became from 20 to 50 per cent. cheaper under the British than under the Peshwa. In the wages of the numerous servants of European gentlemen the same advance has taken place. The superior cheapness in some grains has extended to more than 100 per cent.

In the above notices the rupee has been considered equal to two shillings; the seer of weight equal to 1 lb. 15 oz. 8 drs. 18¾ grs. avoirdupois, or 2 lbs. 4 oz. 6 grs. troy; and the seer of capacity to 2lbs. 6 oz. 3 drs. 24 grs. 92 dec. avoirdupois of Jerwail rice; its cubic contents, 72 in. 2 dec. of water at a temperature of 75° Fahrenheit, at a temperature of 60° therefore being equal to 48 per cent. less than two imperial quarts, or very nearly one quart. Rigidly, the seer is 4·17 dec. per cent. larger than an imperial quart.

Manufactures.

Celebrated as was India for its costly and ingenious cotton fabrics, little more than the memory of them now remains. The machinery of England has enabled her manufacturers to take the raw material out of the hands of the grower, and return it to the continent of India, worked up in various ways, without even affording an opportunity for the application of a prop or stay to the sinking industry of its once flourishing manufacturing classes. As far as relates to Dukhun, its cotton and silk fabrics are confined to coarse dresses for women, tent-cloths, some silk handkerchiefs, and trifling pieces of silk for bosom cloths for women. From an examination of the cotton and silk goods for sale in the markets of Poona, in July 1829, it appeared that every product of the loom, without any exception, with any claim to notice from texture, costliness of material, or ingenuity in the design or workmanship, was an import into the collectorates from native states not under the British government. Turband cloths, varying in length from 24 to 60 cubits, in breadth from three-quarters to 1½ cubits, and in price from one rupee up to sixty rupees each, were from Peytun, Bheer, Narrainpait, Tahr Putruh, Wuswunt, Nandergaon, and Shaghur, in the Nizam's dominions; Boorhanpoor and Jehanabad, in Seendeh's (Scindiah's) dominions, and Chundaree in Malwa, while those made in the city of Poona did not exceed three rupees each in value. The only valuable *Dotruhs* or loin cloths, in length from 20 to 22 cubits, breadth 2½ to 2¾ cubits, and in price from 10 to 40 rupees, were from Muheshwur, in Malwa; the rest were from the Nizam's, Holkar's, and the Rajah of Berar's (Nagpoor) territories. Shahpoor and Belgaon, in the Dharwar collectorate, produced some loin cloths of the value of 25 rupees; those from Poona did not exceed three rupees in value. The *Dooputtehs* or *Shelehs*, cloths for throwing over the shoulder and enfolding the body, in value from 10 to 200 rupees, were from Peytun, Jehanabad, and Boorhanpoor; those from Poona were of the value of five rupees only.

Loogreh or Sarhehs*, varying in length from 13 to 20 cubits, in breadth from 1¾ to 2¾ cubits, and in price from 1½ rupee to 80 rupees, had a wider field of production, even Poona producing these dresses, from one or two looms only I believe, of the value of 80 rupees. New Hooblee, and Shahpoor, in the Dharwar collectorate, produced some dresses of the value of 30 rupees. *Cholkun* or bosom cloths are manufactured at the above places: the highest value of one would appear to be 10 rupees, and the lowest about three-pence. The silk handkerchiefs were chiefly from the Carnatic.

The price of the above articles is influenced partly by the colours, partly by the fineness of the fabric, but chiefly by the quantity of gold and silver thread worked up in them.

Some cotton carpets are manufactured at Ahmednuggur, and in the Jail at Poona, but do not call for notice.

Turbands are dyed of twenty-one colours, but I have not space to give the names: few or none of them are fast colours, with the exception of black and red.

The only woollen manufacture in the collectorates is that of a black smooth blanket, (*Kumlee*) the colour being that of the wool. In general the blanket is coarse, but there is a very fine fabric from Bijapoor. The low state of manufactures is otherwise attested by the fact that, in the Poona collectorate, in the population returns sent to me, the weavers only amounted to 0·35 per cent. of the people, or one weaver for every 280 souls; in Khandesh 0·57 per cent., or one to every 173 inhabitants; and in Dharwar 1·80 per cent., or one in 55 inhabitants, which is prodigiously above the other collectorates. I *estimate* the proportion in the Ahmednuggur collectorate to be the same as that in Poona.

Transit Duties.

The transit duties are farmed; the stations for collecting them are numerous; the rates, although fixed, are unjust, as they are not levied on uniform principles with respect to definite tracts of country. The Carrier is not only interrupted at irregular intervals by British stations, but the alienated towns, so numerously interspersed in the British territories, endeavour to levy duties; moreover, he is perplexed by the money claims of hereditary district officers upon the duties, independently of the customs-farmer's dues. How the conflicting interests are arranged I do not know; but they are so various and troublesome, that the merchant is commonly driven to the expensive necessity of contracting with

* Women's dresses.

a class of people, called *Hoondeekuree*, who undertake for a *fixed sum* to pass all the merchandize through a country to its destination, paying all duties; constant practice, adroitness, and bullying, enabling them to arrange with the collectors better than the merchant could.

All transit duties should be abolished; their amount in the interior of a country materially affects consumption, and is therefore injurious to trade.

Coins.

The only coins in use in Dukhun are silver rupees, half rupees, and copper pice. The rupees are of many mints, and have a different value in relation to the copper coin, resulting from the age of the rupee, and the number of punches or marks it may have on it made by the Shroofs or money-changers in passing through their hands*; the same rupee, of the same standard, and same mint, has not the same value *in copper* in neighbouring districts; this value fluctuates at the pleasure of the money-changers. On what principles they regulate the relative values I do not know. The multiplicity of coins of different mints, and the gradations of coins of the same mint, are great evils. It is unnecessary to enumerate these coins, as they are in the Bombay Almanac.

Weights and Measures.

A very considerable diversity prevails in every district, and often in neighbouring villages, in the weights and measures in use, whether of weight, length, or capacity: this diversity goes so far, that the subdivisions are often found not to be in a determinate proportion to each other. All this confusion is referrible to the want of an ancient permanent standard: to the abrasion or decay of the weights and measures tolerated by government, the knavery of the owners of the weights, and the apathy or connivance of the district authorities †. Everywhere the apparatus of metrology is characterized by clumsiness in construction: rough stones are commonly substituted for stamped metal weights, and joints of the hollow bamboo for authorized definite measures of capacity. The seer of weight was directed by the authorities at Poona and Ahmednuggur to be of eighty Ankoosee rupees, and such a weight may be in use where the district officers are located, but in very few other places. With respect to measures of capacity, not only has each village its own, but I might almost say that each shopkeeper has his own, for it is rare that the weights and measures of any two shopkeep-

* These marks occasion a depreciation of one or more per cent.

† So great are the discrepancies, that they range from 41 per cent. below to 100 per cent. above the Poona standard.

ers are identical; and when it does occur it must be referred to accident. Even the stamping of weights and measures by government officers has not been effectual to insure uniformity; for in a table that I drew up of the discrepancy between the weights and measures of some scores of places all over the country, very many of the weights and measures had the government stamp upon them.

One feature of the measures of capacity is, that, with some exceptions, those of villages are always larger than those of towns and cities. The extent to which this fraud has been carried in military cantonments and large bazaars immediately under British control, is shown in the fact of the reduction of the Serroor cantonment seer, one-twentieth below the standard of Poona city, one-fourth below the standard of Ahmednuggur city, and two-elevenths below the measures of neighbouring districts. But in Bombay it is still more glaring, the origin of whose weights and measures is unquestionably referrible to the Dukhun and Konkun; and yet the Bombay measure of capacity is 41 per cent. less than that of Poona, and about 33 per cent. less than that at Panwell in the Konkun, the nearest great mart to Bombay on the continent The diminution in the seer of weight in Bombay is even more striking. I found the standard seer of weight in the collector's office in Bombay to weigh 4970 grains troy only, while the Panwell seer weighed 13,110 grains, and the Poona seer weighed 13,800 grains, troy. The Panwell seer therefore was 163 per cent. and the Poona seer 177 per cent. larger than the Bombay seer. The knowledge of these facts is of importance to the European and native merchant, as well as to the general consumer.

The evil of a progressive diminution in the weights and measures of Dukhun is arrested in the cities of Poona and Ahmednuggur and the neighbouring cantonments, by standards being kept in the collectors' offices; but as they are not founded on any scientific principles by which they could be restored if lost or *lessened*, their safe custody is of great moment. The seer of weight is directed to be made of a certain number of pieces of the current silver coin, and can therefore be tested without difficulty; but there is not any test, saving the solitary standard in the collector's office, for the measure of capacity. It will be seen that I have given the weight of water of a certain temperature these measures contain, and this determination may be of use at a future period.

Grain measures.—The largest measure of capacity in use is the *Adholee*, of two seers; its name means "the half," it being the half of the *Puheelee*, of four seers, which is not in use. This measure is in the form of an hour-glass. I found the *Poona city* standard to contain 36,400 grains troy, of water, at a temperature of 75° Fahr., or 5 lbs. 3 oz. 3 dr. $5\frac{1}{2}$ grs., or 144·4 cubic inches; and at a temperature of 60.

Fahr. it contained 36,462 grains troy, being 48 per cent. less than an imperial gallon, or very nearly two quarts; rigidly, the seer is 4·17 per cent. larger than an imperial quart. It is curious that the first subdivision of the *Adholee* is not one-half but one-fourth, or half a seer, a seer measure being very rarely in use; then a quarter of a seer, and finally, one-eighth.* In some places there are what are called male and female *Adholees,* one being a little larger than the other; retail traders buy with the largest and sell by the smallest. The multiples are 2 *Adholees* 1 *Puheelee* or 4 seers, 12 *Puheelees* 1 *Mun* (Maund), and 20 *Muns* 1 *Kundee* (Candy); but in some places there are 16 *Puheelees* to the *Mun*: and along the Ghàts, and in the Konkun, there are only 3½ seers to the *Puheelee.* Determined by the weight of the contents of the *Adholee* of well-dried Jerwail rice, the *Kundee* would be 20 cwt. 1 qr. 26 lbs. 10 oz. 12 drs. 16 grs. avoirdupois.

It is necessary to mention that the *four* of *all grains* is sold by weight and not by measure.

Oil, spirits, and milk, are sold by different measures of capacity. These are all professedly founded on the seer of weight; but their discrepancies may well render it doubtful. At one place I found the seer of oil measure to contain 26 rupees' weight of water, at others, 66 rupees', 80 rupees', &c. The forms of these measures are various. The same observations apply to spirit measures. The seer of milk in one place contained 88 rupees' weight of water, in another 93, and elsewhere up to 109 rupees' weight.

Weights.—The standard seer of weight in Poona weighs 80 Ankoosee rupees or 13,800 grains troy, or 1 lb. 15 oz. 8 dwts. 18¾ grs. avoirdupois; but the most common seer in use in Dukhun is one of 76 rupees; the divisions are *Adh seer* (half), *Pao seer* (quarter), *Adh pao* or *Nowtank* (one-eighth), and *Chettank* (one-sixteenth). For the convenience of calculation, the seer is divided into 72 *tanks* or *tollahs,* and one-eighth, of course, is *Nowtank* or nine tanks, and one-sixteenth is *Sarhee chartank* or 4½ tanks, which is corrupted into *Chettank.* The multiples are *Panch seer* (five seers), the *mun* of 40 seers equal to 78 lbs. 13 oz. 11 drs. 11 grs. avoirdupois, or 95 lb. 10 oz. troy exactly; the *Pullah* of 3 *muns,* and the *Kundee* of 20 *muns.* But I have shown how far the weights really in use differed from the above, and in the tract lying between the Seena and Beema rivers, the weight called the *Bureedee* had not even the same constituents or multiples as the Poona weights.

* Sellers of sweetmeats have 1-16th of a seer.

Goldsmiths' weights.—The lowest goldsmiths' weight is nominally the mustard seed, but the lowest I met with was the *Goonj*, a seed of the *Abrus precatorius*, the mean weight of which was 1·91410 grains troy: 96 *goonj* make a *tollah*, which should therefore weigh 183·7536 grains troy; but as the *tollah* is the 72d part of a seer of 13,800 grains, it should weigh 191,666 grains troy; the goldsmiths' weights in use consequently are below the nominal standard. Eight *goonj* or four *waals** make one *massah*, and twelve *massah* one *tollah*. I put the goldsmith's weights to the same test in different parts of the country, I did those of capacity, and found that two weights of the same denomination in different shops were seldom uniform. The scales used by goldsmiths are called *Kanteh*, and are of metal; those used by dealers generally are called *Tajwa* or *Tagree*, and are made of leather or parchment.

Itinerary and Long Measures.—Distances between places are *estimated* by the *Kohs* (coss), I cannot say *measured*, for I believe the actual determination of distances between places was as little attended to by the native governments, as the facilitating communications through the country by the construction of roads and bridges. I *think* the *Kohs* averages about two miles English, varying, however, from 1½ to 2½ miles. In Mahratta writings long measure is raised from the barleycorn: 8 *Juw* or barleycorns make a *Boht* or finger, 24 fingers a *Haht* or cubit, (18 inches), 4 cubits a *Dunoosh* (a bow) or fathom, measured by a man's outspread arms, and 8000 cubits or 2000 fathoms a *Kohs*. The *Kohs* therefore would equal 2¼ English miles and 40 yards. In Sanscrit 2 *Kohs* make a *Guwyotee*, and 2 of the latter make a *Yojun* or 9 miles and 160 yards; but these terms are unknown to the common people. In fact, however, the measure of length originates in the well-known *Haht* or cubit, determined by the *mean length* of five men's arms, measured from the elbow-joint to the end of the middle finger: the *Haht* or cubit so determined, is a little more than 18 inches in length; this is divided into 2 *Weets* or spans, into 6 *Mooshtees* or fists, and each fist into 4 *Bohts* or fingers, and the latter into 8 barleycorns each. Tailors and sellers of cloth use a *Guj*, which is divided into 16 *Ghirra*, each of 1½ *Tussoo*, each *Tussoo* of 2 *Bohts*, and as each *Boht* is equal to a fraction more than ¾ of an inch, the *Guj* would be a little more than an English yard.

Superficial Measure.—The only land measure of any exact and appreciable extent is the Beegah, which is of Moosulman derivation, but by some referred to the Sanscrit word *Weegruhuh*, although this word is not applied to land measurements; and as all genuine Mahratta terms

* Waal is the seed of the Cæsalpinia sappan.

applied to the capacity, extent, or capabilities of land, are not referrible to the Beegah or its multiples, I must consider the Beegah of Moosulman introduction. Like itinerary measures, it is raised from the *Haht* or cubit of a fraction more than 18 inches in length; 5 *Hahts* and 5 *Mooshtees* (fists or palms) make 1 *Kattee* or stick, 20 square *Kattees* or sticks make 1 *Paand*, and 20 *Paands* a *Beegah;* reduced to English measurements, the 5 *Hahts* and 5 *Mooshtees* will be equal to 105 inches in length, and the square of this sum will be 11,025 inches in a square *Kattee* or stick, and 20 *Kattees* a *Paand* equal to 220,500 inches, and 20 *Paands* a Beegah or 4,410,000 square inches; and as the English statute acre contains 43,560 square feet, the Beegah is to the acre as 70⅓ is to 100, or as 211 to 300, being a trifle more than seven-tenths of an acre. But as the *Haht* or cubit is a fraction more than 18 inches, the Beegah may fairly be considered equal to three-fourths of an acre: but I very much doubt whether any other than garden lands were actually measured by the Moosulmans; and in converting the Hindoo terms *Kundee*, *Mun*, *Doree*, and fifty other denominations, into Beegahs, it was done by *estimate*; and this explanation will account for the variable size of the Beegah in different parts of the country, which the British survey has discovered. The only multiples of the Beegah, to my knowledge, are the *Rookeh* of 6 Beegahs or 4½ acres, and the *Chahoor* of 120 Beegahs or 90 acres: these terms are of Moosulman origin.

Adverting to the past and present state of the knowledge of native governments in politics, political economy and science, it would be idle to refer the origin of their weights and measures to scientific principles, immutable standards, or even to any uniform, although arbitrary system. Their long measure is derived from the human arm, and their weights from a seed. In these derivations they have not been a whit more irrational than the good people of England, whose standard measure of length, the *Ulna* or *Ell*, is derived from the arm of one of their kings, (Henry the First), and their weights from grains of wheat. There is a great coincidence between the native weights and measures and those of antiquity. The first five subdivisions of the scripture measures of length are identical in their derivation, and nearly so in their length, with those of Dukhun; namely, the finger, fist or palm, span, *Haht* or cubit, and fathom; both also have the coincidence of being destitute of a measure equivalent to a foot. The foot was a constituent of the ancient Greek and Roman measures; but in *practice* these nations used the finger, palm, and cubit; and the *Pecus* or great cubit of the Greeks was precisely of the length of the Dukhun cubit, namely, a fraction more than 18 inches.

The ancient grain and liquid measures of England were raised from weight from a pound troy. For a very long period I had believed the measures of capacity in Dukhun to be entirely arbitrary: but in the southern part of the country between the Seena and the Beema rivers, I met with *Adholees* with *stamps* on them, directing that they should contain a *certain weight* of grain: for instance, at Punderpoor the *Adholee* was to contain as much *Johr Guhoon* (wheat), as would weigh 200 Ankoosee rupees, at Mohol 160 rupees' weight of Joaree (*Andropogon Sorghum*), at Taimbournee 131 rupees' weight of Joaree, and at Kothool, near to Ahmednuggur, 200 Ankoosee rupees' weight of Bajree (*Panicum spicatum*). I know not whether this slight indication of systematic deduction of measures of capacity from those of weight is attributable to the Moosulmans or to the Hindoos. The places where they were met with, with one exception, had until recently, been for ages under a Moosulman government (the Nizam's), but it might have been practised before the arrival of the Moosulmans. It does not appear to have occurred to the natives to use the weight of water, as the least changeable standard by which to fix the capacity of a measure.

Army.—The army consists of some of the royal troops paid by the India Company; of European regiments of artillery and infantry belonging to the Company, and of native regiments of cavalry, infantry, and pioneers, armed, clothed and disciplined in the same manner as the European troops. The army is separated into divisions commanded by General Officers and Brigadiers-General, and the divisions are divided into brigades, which are so stationed as to co-operate in the readiest and most efficient manner in emergencies, for the protection of the country and the maintenance of the civil power.

Justice.—Not having been able to get blank forms filled up at the India-House with the necessary data respecting crimes and punishments, I abstain from any notice of judicial matters.—*Report of the Seventh Meeting of the British Association for the advancement of Science.*

X.—Literary and Scientific Intelligence.

Our meteorological correspondents will be glad to learn that their observations are valued and will be turned to account by Sir John Herschel, who thus writes to us from Hanover, under date 24th July 1838.

"When I left the Cape, I desisted from the further prosecution of the solsticial and equinoxial observations, but my best thanks are due to all those gentlemen who have supplied me with corresponding observations, and it will be one of my first objects, so soon as I shall be returned to England and in possession of *a fixed residence*, as well as of all my papers, and of some degree of leisure, to enter upon the task of their arrangement and reduction—to do justice, in so far as in me lies, to the great zeal and ability manifested in the communications of the observations which have reached me from various quarters.

"I regret to say, however, that the stations at which these observations have been made have neither been sufficiently numerous, nor (except in some few cases) the observations at each sufficiently continuous, to enable me to draw any *general* conclusions from them. Beyond the latitudes +40 and — 40, indeed, as I have already taken occasion to state in a circular addressed to all my meteorological correspondents, the *epochs* themselves are not sufficiently numerous; and to be of service the observations would require to be prosecuted monthly instead of quarterly, and pursued for many successive years, in stations systematically distributed.

"In India, where the meteorology is more simple and determinate, even a single year's series, is capable of affording interesting information, and I shall therefore be very glad to see the observations to which you allude, as being made at three stations* in Southern India. In all cases I would recommend that such observations should be published in the scientific Journals most accessible at the points where they are made. The transmission of MSS. is hazardous and circuitous, and there is a great advantage in placing the data on which theories are to be grounded as early and extensively as possible before *the public*."

* Madras—Trevandrum—and Hoonsoor. We regret that we have not received them from the latter station since March 1838.—Editor.

The Reverend William Taylor, Collator and Examiner of the Mackenzie MSS. has sent in his 5th report, the 6th and 7th being under preparation. He concluded his labours in January last, which have been carried on with industry and ability highly creditable to him. He has furnished five magnificent folio volumes of restored manuscripts, indicated in the course of his reports; each of them consisting of between 7 and 800 pages, which are really beautiful specimens of native caligraphy, in various languages, on the best English paper, and handsomely and substantially bound in green Morocco leather. The style of getting these volumes up, is entirely the spontaneous offspring of Mr. Taylor's liberal mode of executing his task, which pledged him to nothing but a simple transcript of the injured MSS. We hope to be able to introduce at a future period a more elaborate notice of Mr. Taylor's labours: with some critical examination into the intrinsic value of these far-famed and costly (though, we believe, much over-rated), oriental manuscripts.

XI.—*Horary Meteorological Observations made agreeably with the suggestions of Sir* John Herschel.

1st.—*At the Madras Observatory.—By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

1839	Time.	Barometer.	Thermometer. Dry.	Thermometer. Wet.	Wind.	Remarks.
		In.	°	°		
Mar. 21	6 A. M.	30.054	82.0	77.6	N. W.	Gentle wind, thick haze.
	7 ,,	.078	80.4	77.5	W.	do. do.
	8 ,,	.100	82.3	78.1	N. W.	do. do.
	9 ,,	.116	83.4	78.5	do.	do. breeze, flyg. clds.
	10 ,,	.100	84.7	76.8	do.	do. do.
	11 ,,	.068	86.3	78 0	S. E.	Moderate wind, flyg. clds.
	12 ,,	.034	87.8	76.4	S. E.	do. flyg. clds.
	1 P.M.	.004	88.0	77.5	S. E.	do. do.
	2 ,,	.000	87.9	77.9	S. E.	Strong wind, clear.
	3 ,,	29.984	87.7	79.0	E. by S.	do. do.
	4 ,,	.966	87.8	78.9	E. N. E.	do. do.
	5 ,,	.960	86.0	77.5	E. N. E.	do. do.
	6 ,,	974	84.2	77.4	N. E.	do. do.
	7 ,,	30.002	83.6	77.0	S. E.	do. haze.
	8 ,,	.036	83.0	77.0	S. E.	do. cloudy lightning to the west.
	9 ,,	.028	82.8	77.0	E.	do. do. do do.
	10 ,,	.050	82.8	77.0	E.	Gentle wind do. do.
	11 ,,	.038	82.0	77.0	S. E. E.	do. clear.
	12 ,,	.026	81.5	76.7	E.	do. flyg. clouds
	1 A. M.	.002	81.8	77.5	——	Calm, cloudy.
	2 ,,	.002	80.5	76.5	——	do. do.
	3 ,,	.000	79.8	76.2	N. W.	Gentle wind—clear.
	4 ,,	29.980	79 8	75 5	W.	do. do.
	5 ,,	.960	79.6	75.2	W.	do. do.
	6 ,,	.976	76.7	74.6	W.	do. do.
	7 ,,	30.002	77.5	75.7	——	Calm do.
	8 ,,	.040	81.3	77.1	S. W.	Gentle wind, do.
	9 ,,	.054	83.5	77.3	W.	do. flyg. clouds
	10 ,,	.066	85.0	76.9	N. E.	Breeze do.
	11 ,,	.054	86.7	77.6	E.	Gentle wind, do.
	12 ,,	.032	87.6	77.1	E.	Strong wind, clear.
	1 P. M.	.000	88.3	75.9	E.	Moderate wind, do.
	2 ,,	29.985	89.0	74.5	E.	do. do.
	3 ,,	.964	88.0	76.5	S. E. by E.	do. do.
	4 ,,	.950	86.5	77.5	do.	do. do.
	5 ,,	.952	85 5	77.0	do.	do. do.
	6 ,,	.954	84.0	76.5	do.	do. do.

2*d.*—*Horary Meteorological Observations made at the Vernal Equinox* 1839, *at the Trevandrum Observatory.*—*By* G. SPERSCHNEIDER, *Superintendent.*

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard ther.	Depress of wet bulb thermometer.	Temp. of dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky, and remarks.
March 21	6 A. M.	29.725	73.8	3.7	68.22	S E by E	3		Sky covered with thick haze—gentle wind.
	7	.747	75.8	3.2	71.15	do	,,	0.8	Light clouds in the zen. cum. in the N. E. horizon calm.
	8	.756	79.6	5.8	71.21	do	,,	2.0	Zen. clear cum. stratas in do. do.
	9	.752	83.7	9.6	69.76	do	,,	1.5	do. do. do.
	10	.771	88.0	12.9	69.33	S W	3	5.5	do. do. gentle wind.
	11	.758	90.3	14.2	69.95	do	3	6·0	do. do. do.
	Noon.	.727	90.0	12.9	71.79	do	10	10.0	do. do. pleasant B. gale
	1 P. M.	.700	90.0	14.3	69.38	do	10	6.3	do. cum. about hor. thunder on the E. do.
	2	.673	89.8	11.4	68.96	S S W	6	11.3	do. do. pleasant wind
	3	.650	89.2	13.6	69.61	S W	6	11.3	do. do. do. decreasing
	4	.636	88.0	12.7	69.68	do	4	2.3	do. do. gentle wind.
	5	.656	86.5	10.9	70.92	do	2	1.0	Zen. rather clear, rest cloudy—wind just perceptible.
	6	.683	84.7	9.6	70.94	do	2		do. thick cum. about hor. do.
	7	.705	84.2	8.6	71.98	do	2		Sky very cloudy, lightning continued,—halo round the moon.
	8	.735	83.7	7.6	72.99	do	,,		do. drizzling calm.
	9	.738	83.7	7.8	72.67	S W	1		do. do. light air.
	10	.749	82.8	6.9	73.07	do	,,		do. calm.
	11	.745	80.8	5.1	73.62	do	,,	No observation.	Sky becoming clear sheet lightning in the S. S. E. calm.
	Mid.	.734	79.4	4.6	72.86	N N E	1		Zenith pretty clear, cum. about horizon, nearly calm.
,, 22	1 A. M.	.692	79.4	3.8	74.06	do	,,		Sky in general clear, sheet lightning in the S. calm.
	2	.682	79.2	3.9	73.70	do	,,		do do. continued do.
	3	.682	78.2	3.4	73.38	do	,,		Sky getting cloudy do.
	4	.676	77.4	3.1	72.99	N E by E	1		Sky rather clear do.
	5	.695	76.0	2.2	72.86	do	,,		Overcast and threatening do.
	6	.702	76.5	2.4	73.08	do	,,		Zen. rather clear rest cloudy do.
	7	.733	77.8	3.2	73.26	do	,,	3.0	do. do do.
	8	.733	81.5	5.4	73.92	do	,,	,,	do. do. do.
	9	.752	84.1	7.1	74.19	do	,,	,,	Sky very cloudy do. do.
	10	.774	86.5	10.4	71.74	N by E	,,	2.0	do light air.
	11	.753	87.6	10.5	72.86	N W by W	3	5.2	Cirrous dispersed gentle wind.
	Noon.	.724	88.9	12.2	71.63	W	3	,,	Cloudy do.
	1 P. M.	.691	89.1	12.5	71.37	W S W	6	3.8	do. pleasant wind.
	2	.673	87.6	10.5	72.86	S W	6	5.3	Zen. clear, rest becoming cldy. do.
	3	.650	88.3	11.9	71.41	do	3	4.3	do. gentle wind.
	4	.637	86.8	10.4	72.09	do	6	4.0	do. do. at 4h 30m thunder in the N. E. pleasant wind.
	5	.651	84.8	8.9	72.18	do	3	,,	Sky covered with thick clouds, and threatening, gentle wind.
	6	.676	84.0	8.9	71.26	do	3	,,	do. do. do.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY, FOR THE MONTH OF JANUARY, 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain Sun-rise.	Rain Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Weather. 10 P. M.	Remarks.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Jan. 1	30,126	30,036	30,086	78,2	78,6	78,2	4,7	5.6	5,2	......	......	......	N	N E	N E	Clear	Fl. cl.	Fl. cl.	
2	,100	,032	,082	77,7	79,6	76,2	5,3	5,9	5,3	......	......	1.794	E	S E	E	Clear	Fl. cl.	Fl. cl.	
3	,108	,038	,122	76,9	78,8	76,0	7,7	6,8	5,7	......	......	......	N E	E	E	Fl. cl.	Fl. cl.	Fl. cl.	
4	,124	,054	,130	76,8	80,0	76,7	4,4	7,0	5,0	......	......	......	N	N E	N E	Fl. cl.	Fl. cl.	Clear	Dew.
5	,142	,058	,108	78,9	80,5	76,3	6,0	7,0	4,5	......	......	......	E S E	E N E	N E	Clear	Clear	Clear	Dew.
6	,120	—	,092	77,8	—	76,0	4,8	—	4,9	......	......	......	N	—	N	Fl. cl.	—	Fl. cl.	Dew.
7	,127	,040	,090	76,5	79,7	76,5	4,5	8,2	5,1	......	......	......	N	N E	N E	Fl. cl.	Clear	Fl. cl.	—
8	,126	,044	,110	77,4	79,4	76,9	5,0	7,9	7,0	......	......	......	N N E	N N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	Dew.
9	,114	,014	,078	77,0	79,0	76,7	5,0	7,5	5,2	......	......	2,114	N E	N E	N E	Th. hz.	Th. hz.	Fl. cl.	—
10	,078	,004	,082	77,2	80,0	76,6	5,9	8,3	6,6	......	......	......	E	E	E	Fl. cl.	Clear	Clear	Dew.
11	,106	,006	,068	76,7	80,0	77,7	5,8	8.8	6,7	......	......	......	E	E	E	Haze	Clear	Fl. cl.	—
12	,074	29,950	,022	76,8	80,5	75,7	6,5	8.8	5,4	......	......	......	N W	E	S E	Clear	Clear	Clear	Dew.
13	,056	—	,044	77,7	—	77.6	5,7	—	5,7	......	......	......	S	—	S E	Fl. cl.	—	Clear	Dew.
14	,100	30,010	,082	77,7	81,0	78,3	8,4	6,0	3,6	......	......	......	N E	E	S E	Fl. cl.	Clear	Fl. cl.	Dew.
15	,126	,018	,094	80,2	81,8	78,7	3,7	5,8	3,3	0,087	......	......	E S E	E S E	S E	Fl. cl.	Fl. cl.	Fl. cl.	Dew.
16	,110	,016	,056	80,5	82.8	79,5	3,7	5,8	3,4	......	......	1,896	S E	S S E	S E	Fl. cl.	Clear	Clear	Dew.
17	,096	,018	,072	80,9	82,8	80,0	3,8	5,8	3,7	......	......	......	S	S S E	S E	Fl. cl.	Clear	Fl. cl.	Dew.
18	,106	,020	,042	80.7	83,0	79,7	3,3	5,5	4,9	......	......	......	S	S E E	S E	Fl. cl.	Clear	Clear.	Dew.
19	,082	29,996	,032	80,6	82,5	79,7	4,1	6,0	3,7	......	......	......	S W	S	S	Clo	Clear	Clear.	Dew.
20	,055	—	,042	81,0	—	80,0	4,5	—	2,8	0,047	......	......	S	—	S SE	Fl. cl.	—	Clo. in the ho.	
21	,056	29,990	,038	81,7	83,0	80,1	4,4	5,3	3,2	......	......	......	S	S S E	S S E	Fl. cl.	Clear	Fl. cl.	
22	,100	30,000	,066	81,2	83,0	81,7	3,7	5,0	4,2	......	......	......	S E by S	S	S E	Fl. cl	Clear	Fl. cl.	Lightning.
23	,100	,002	,072	81,9	83,0	79,7	6,4	6,5	4,8	......	......	2,134	S E	S E	E S E	Fl. cl.	Clear	Fl. cl.	Do.
24	,152	,108	,172	81,8	80,8	78,8	5,2	4,8	4,6	......	......	......	E	E	E	Fl. cl.	Clo.	Rain	Do.
25	,194	,088	,148	79,4	80,8	78,7	5,4	6,6	3,6	2,981	......	......	N E	N E	N E	Clo.	Clear	Fl. cl.	Do.
26	,172	,068	,144	79,7	80,0	77,7	5,1	7,2	6,2	0,227	......	......	N E	E N E	N E	Clear	Clo.	Fl. cl.	Dew.
27	,178	—	,186	78.3	—	77,6	6,8	—	7,5	......	......	......	[illegible]	—	N E	Fl. cl.	—	Fl. cl.	Do.
28	,206	,126	,208	78,8	79,8	78,1	6,8	8,1	5,2	......	......	......	N. E	N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	Do.
29	,224	,144	,202	79,3	80,8	78,5	6,8	7,9	6.9	......	......	......	N N E	E N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	Do.
30	,224	,106	,200	80,0	81,0	78,6	6,1	7,5	4,5	......	......	2,324	E N E	E N E	N E	Fl. cl.	Clo.	Fl. cl.	—
31	,196	,094	,142	80,5	81,9	78,2	5,9	6,9	5,7	......	......	......	E N E	E	E	Fl. cl.	Fl. cl.	Fl. cl.	—
Mean	30,125	30,040	30,100	79,0	80,9	78,0	5,3	6,8	5,0										

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY, FOR THE MONTH OF FEBRUARY 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of wind. 10 A. M.	Direction of wind. 4 P. M.	Direction of wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Weather. 10 P. M.	Remarks.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Feb. 1	30,160	30,072	30.136	78,8	80,0	78,2	6,0	7,5	6,1	......	......	......	E. N E	N E	N E	Fl. cl.	Cloudy	Fl. cl	Dew.
2	,141	,068	,134	78,0	80,0	77,6	5,4	7,8	6,6	......	......	......	E	E. N E	N E	Fl. cl.	Fl. cl.	Fl. cl.	Do.
3	,156	—	,128	79,2	—	78,1	7,1	—	7,1	......	......	......	E	——	N E	Fl. cl.	——	Haze	Do.
4	,126	,050	,092	79,7	80.6	78,2	7.1	7,1	5,8	......	......	......	E	E	E	Clear	Clear	Clear	Do.
5	,112	,030	,100	78,3	80.5	78,0	4.7	7,5	4.5	......	......	......	N E	E	N E	Fl. cl.	Th. hz.	Fl. cl.	——
6	,128	,042	,132	79,7	81.5	79,8	6,2	7,5	5,3	......	......	2,283	N. N E	E	E	Haze	Haze	Fl. cl.	——
7	,158	,070	,150	79,1	79,7	79,2	4,0	5,7	5,9	......	......	......	N E	N E	E	Fl. cl.	Cloudy	Fl. cl.	——
8	,150	,062	,140	79,0	80,0	78,2	5,5	6,0	5,1	......	......	......	E	E. N E	E	Fl. cl.	Fl. cl.	Fl. cl.	Dew.
9	,102	,012	,062	79,7	80,8	80,0	5,2	5,8	5.4	......	......	......	E	E	E	Fl. cl.	Clear	Cloudy	——
10	,102	,016	,082	81,1	82,8	79,7	5,6	7,8	4,3	......	......	......	S	E	E	Fl. cl.	Clear	Clear	Dew.
11	,084	,014	,082	80,8	82.2	78,4	5.3	7,2	4,9	......	......	......	S E	E	E	Fl. cl.	Clear	Clear	Heavy dew.
12	,084	29,992	,024	79,2	82,0	76,3	3,7	7,0	4,9	......	......	......	S W	E	E	Fl. cl.	Clear	Clear	Do. do.
13	,028	,958	29,982	79,0	82,0	77,3	5,0	6,0	3,1	......	......	2,108	S	S E	S W	Clear	Clear	Clear	Do. do.
14	,010	,954	30.012	79,4	82,5	77,8	5,4	5,5	4,5	......	......	......	S W	S E. E	S	Clear	Clear	Clear	Do. do.
15	,046	,955	29,975	79,1	83,0	78,1	5,9	8.0	4.6	......	......	......	S	S E	S E	Clear	Clear	Clear	Do. do. *along shore,*
16	,014	.942	.994	80,5	83,8	79,1	5,5	7.8	2,0	......	......	......	S E	S E	S E	Clear	Clear	Clear	Do. do. [wind com-
17	,020	,916	30,000	82.5	85,2	80,1	6,5	8,7	2,6	......	......	......	S W	S	S E	Clear	Clear	Clear	[mences.
18	,070	,938	,082	83.5	84,4	80,9	6,5	6,4	3,7	......	......	......	S E	S. S E	S E	Clear	Clear	Clear	Dew.
19	,110	30,020	,096	82,0	84,0	79,8	6,4	7.5	4,3	......	......	......	S. S E	S E	S E	Clear	Clear	Clear	Do.
20	,146	,054	,119	79,9	82,2	78,3	4,9	7,7	5.9	......	......	2,434	S E	S E	S	Fl. cl.	Haze	Clear	Do.
21	,172	,088	,134	80,0	83,0	76,7	8,9	10,0	5,0	......	......	......	E	S E	S	Clear	Clear	Clear	Do.
22	,178	,078	,159	80,0	82,0	78,1	7,6	9,3	6,0	......	......	......	E	E	E	Fl. cl.	Fl. cl.	Fl. cl.	Do.
23	,159	,054	,130	78,6	81,0	75,8	7,1	8,0	4,3	......	......	......	S E	E	E	Fl. cl.	Th. hz.	Clear	Heavy dew.
24	,150	—	,100	78,1	—	75,6	5,1	—	5,2	......	......	......	S W	——	E	Clear	——	Clear	Do. do.
25	,116	,022	,086	78,2	83,0	76,0	4.0	7,5	4,1	......	......	......	E	N E. E	E	Clear	Clear	Clear	Do.
26	,099	29,996	,039	77,7	82,2	79,1	4,8	6,6	4,8	......	......	......	W	E	E	Fl. cl.	Clear	Clear	Do.
27	,036	,954	,000	80,3	83,8	79,1	5,8	8,3	5,6	......	......	2,147	S	E. S E	E	Clear	Clear	Clear	
28	,072	,968	,054	80,0	83,6	80,1	5,9	8,1	5,1	......	......	......	S E	E. S E	E	Clear	Clear	Clear	
Mean	30,104	30.016	30,077	79,7	82,1	78,3	5,8	7,0	4,9										

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY, FOR THE MONTH OF MARCH, 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Weather. 10 P. M.	Remarks.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o										
Mar. 1	30,108	29,984	30,082	81,8	84,0	80,2	7,3	9,0	6,5	......	......	......	SE	SE	E	Clear	Clear	Clear	Dew.
2	,098	30,000	,078	81,2	83,7	80,2	6,7	8,0	5,6	......	......	......	NW	E	E	Clear	Haze	Clear	Dew.
3	,124	—	,068	81,8	—	80,3	6,4	—	4,7	......	......	......	NE	—	E	Fl. cl.	—	Fl. cl.	Dew.
4	,118	30,004	,068	80,1	82,5	81,3	3,5	5,5	3,8	......	......	......	N	NE	NE	Cloudy	Cloudy	Cloudy	
5	,106	29,990	,078	82,2	84,5	81,6	3,5	5,0	3,5	......	......	......	NE	E	E. NE	Cloudy	Cloudy	Fl. cl.	Few drops of rain.
6	,092	,982	,070	82,7	84,6	81,7	4,7	6,1	5,3	......	......	1,549	E	E. SE	SE	Fl. cl.	Fl. cl.	Clear	Dew.
7	,070	,958	,016	82,6	84,7	80,7	5,2	6,2	4,2	......	......	......	E	E. SE	SE	Fl. cl.	Clear	Clear	Dew.
8	,086	,970	,034	82,0	85,0	80,9	6,1	7,5	4,5	......	......	......	SE	S	S	Fl. cl.	Clear	Haze	Dew.
9	,068	,950	,004	82,5	86,0	82,0	5,5	7,0	3,5	......	......	......	SW	S	SE	Clear	Clear	Clear	Thick fog.
10	,032	—	29,952	83,4	—	81,8	5,4	—	4,6	......	......	......	SW	—	SE	Clear	—	Clear	Dew.
11	,012	,918	,972	83,6	87,4	82,4	7,0	9,1	7,3	......	......	......	SW	S. SE	S	Clear	Clear	Clear	Dew.
12	,028	,934	30,000	84,1	87,0	82,1	7,5	9,0	3,4	......	......	......	SW	SE	S. SE	Clear	Clear	Clear	Dew.
13	,054	,956	,038	84,3	86,0	82,0	6,8	8,1	5,1	......	......	2,701	SW	S. SE	S	Clear	Clear	Fl. cl.	Dew.
14	,080	,974	,056	83,9	85,0	80,8	7,9	7,0	5,6	......	......	......	SW	SE	SE	Clear	Clear	Clear	Dew.
15	,110	30,008	,100	83,3	84,2	80,3	7,3	6,2	5,0	......	......	......	SW	E. NE	SE	Clear	Clear	Clear	Dew.
16	,160	,050	,108	82,3	84,6	80,2	7,4	7,6	6,5	......	......	......	E	E. SE	SE	Fl. cl.	Clear	Clear	Dew.
17	,106	—	,070	82,7	—	81,4	7,1	—	5,0	......	......	......	SE	—	E	Clear	—	Fl. cl.	Dew.
18	,128	29,988	,074	83,2	85,8	82,5	7,8	5,8	4,1	......	......	......	SE	E. SE	SE	Clear	Fl. cl.	Clear	Lightning to the S. E.
19	,106	30,024	,070	85,2	85,0	84,0	5,7	5,0	4,5	......	......	......	E	SE	SE	Cloudy	Cloudy	Fl. cl.	Do. do.
20	,124	,020	,088	85,6	84,6	84,1	6,8	5,1	5,1	......	......	2,741	SE	E. NE	SE	Fl. cl.	Cloudy	Fl. cl.	Do. do.
21	,100	29,965	,050	84,7	87,8	82,8	7,9	8,9	5,8	......	......	......	NW	E. NE	E	Fl. cl.	Clear	Cloudy	Do.
22	,055	,950	,022	85,0	86,5	83,6	8,1	9,0	8,0	......	......	......	NE	SE by E	SE	Fl. cl.	Clear	Clear	Dew.
23	,068	,980	,062	84,3	86,5	83,7	7,1	8,2	6,1	......	......	......	S	SE	SE	Clear	Clear	Clear	Dew.
24	,092	—	,072	84,1	—	84,5	7,9	16,5	6,8	......	......	......	SW	—	SE	Clear	—	Clear	Dew.
25	,082	,962	,019	84,0	89,0	84,1	7,0	9,6	8,0	......	......	......	SW	E. SE	SE	Clear	Clear	Clear	Dew.
26	,032	,940	29,994	84,5	87,8	83,0	12,0	9,6	6,5	......	......	......	SW	S. SE	SE	Clear	Clear	Clear	Dew.
27	,020	,918	,972	81,1	86,0	78,2	9,1	8,0	5,8	......	......	3,288	SW	S. SE	SW	Clear	Clear	Clear	Dew.
28	29,992	,914	,988	82,8	87,0	82,2	10,2	7,5	4,2	......	......	......	SW	S. SE	SW	Clear	Clear	Clear	Dew.
29	,991	,910	,968	84,0	86,5	82,2	7,5	7,5	3,2	......	......	......	S	S. SE	S	Clear	Clear	Clear	Dew.
30	[illegible]78	,894	,950	83,8	87,0	82,1	8,7	7,8	3,9	......	......	......	SW	S	SE	Clear	Clear	Clear	
31	[illegible]12	—	30,000	84,0	—	82,2	7,8	—	4,6	......	......	......	SW	—	S. SE	Clear	—	Clear	
Mean	30,072	29,967	30,036	83,3	85,7	81,9	7,1	7,8	5,2										

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory : are about 5 feet above the surface of the ground, and 27 feet above the level of the Sea.

The barometer employed is No. 1, one of two Standards which I had constructed at the end of the year 1836, to supply the place of those broken during the storm : the indications set down are those immediately read off from the instrument, and consequently require in addition to the ordinary correction for temperature, the correction +,051 for capillarity : from a late comparison of these with a magnificent standard by Newman which had been constructed with all the advantages of modern improvement for the Trevandrum Obsesvatory, it appeared that when *corrected for capillarity*, the

Trevandrum Standard stood at		30,000	inches.
the Madras	No. 1	30,001	do.
	No. 2	29,993	do.

The thermometer was made on purpose for the Observatory, and at 72° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard :

	h.	*m.*	*s.*
Longitude	5	21	8 E.
Latitude	13°	4′	8″,5 N.

T. G. TAYLOR,
H. C. Astronomer.